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Ministry of Higher Education and Scientific Research
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Faculty of Building Engineering

CONFERENCE ABSTRACTS

*International Conference on Engineering Sciences for a Sustainable
Environment*
ICESSE'25



*International
Conference on
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Sustainable
Environment*

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1. About

The Building Engineering Faculty of the Mouloud MAMMERI University of Tizi-Ouzou is honored to host the "International Conference on Engineering Sciences for a Sustainable Environment – ICESSE'25", a significant event bringing together researchers, students, and professionals in engineering and environmental sciences. This conference aims to explore scientific and technological advancements in engineering and environmental sustainability. This edition follows the seminar shield in previous years: CMMS08 and CMMS14. It seeks to expand its scientific activities by strengthening partnerships between academic stake holders and key players in the socio-economic sector. The Faculty of Construction Engineering is proud to serve as a hub for interdisciplinary ideas and exchanges. This event aspires to reinforce international collaborations and promote innovative approaches to addressing global environmental challenges, offering a platform for reflection and discussion toward sustainable, environmentally respect full development. We invite you to actively contribute to this prestigious event to advance research and innovation in service of the planet. Participants will have the opportunity to discuss technological advances and concrete projects aimed at improving the fields of Civil Engineering, Mechanical Engineering, Hydraulic Engineering, Energy Efficiency, and Environmental Engineering on local, national, and international scales.

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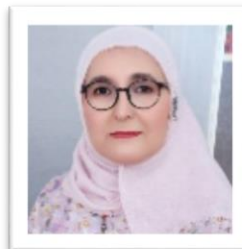
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BAZIZ Karim	Univ.Tizi-Ouzou, Algeria.	DJEBOURI Hassene	Univ.Tizi-Ouzou, Algeria.
BELAID Kamel	Univ.Tizi-Ouzou, Algeria.	JABALLAH Mohamed	Univ.Tizi-Ouzou, Algeria.
BELDI Mustapha	Univ.Tizi-Ouzou, Algeria.	LOUNIS Mohand	Univ.Tizi-Ouzou, Algeria.
BENABDESSELAM Djédjiga	Univ.Tizi-Ouzou, Algeria.	HADJ Ali Youcef	Univ.Tizi-Ouzou, Algeria.
BEN CHABANE Tarik	Univ.Tizi-Ouzou, Algeria.	IDEKKI Said	Univ.Tizi-Ouzou, Algeria.
BENCHERIF Mokhtar	Univ.Tizi-Ouzou, Algeria	KACIMI Bachir	Univ.Tizi-Ouzou, Algeria.

BOUDEDJA Amar	Univ.Tizi-Ouzou, Algeria	MERAKEB Seddik,	Univ.Tizi-Ouzou, Algeria.
BOUZID Leyla	Univ.Tizi-Ouzou, Algeria.	OUTAYEB Sonia	Univ.Tizi-Ouzou, Algeria.
CHIBA Salim	Univ.Tizi-Ouzou, Algeria.	SELMi Hacene	Univ.Tizi-Ouzou, Algeria.
CHERIFI Fatiha	Univ.Tizi-Ouzou, Algeria.	TEKLAL Fatiha	Univ.Tizi-Ouzou, Algeria

3. Topic

3.1 Topic 1 : Civil Engineering (CE)

1. Structural analysis and design (SAD)
2. Construction materials and technologies (CMT)
3. Geotechnical engineering (GE)
4. Transportation infrastructure (TI)
5. Earthquake and disaster engineering (EDE)

3.2 Topic 2 : Mechanical Engineering (ME)

1. Mechanical design and CAD (MD-CAD)
2. Fracture mechanics and damage modeling (FMDM)
3. Composite materials and polymers (CMP)
4. Manufacturing processes (MP)
5. Dynamics and control systems (DCS)

3.3 Topic 3 : Hydraulic Engineering (HE)

1. Open channel flow (OCF)
2. Urban drainage and sewer systems (UDSS)
3. Hydraulic structures (HS)
4. Groundwater hydraulics (GH)
5. Flood risk management (FRM)

3.4 Topic 4 : Energy Efficiency (EE)

1. Thermodynamics and heat transfer (THT)
2. Solid and fluid mechanics (SFM)
3. Building energy performance (BEP)
4. Smart grids and energy management systems (SGEMS)
5. Renewable energy integration (REI)

3.5 Topic 5 : Environmental Engineering (EnE)

1. Waste management and recycling (WMR)
2. Environmental impact assessment (EIA)
3. Soil and groundwater remediation (SGR)
4. Artificial intelligence for the environment (AIE)
5. Climate change adaptation and mitigation (CCAM)

Plenary Conferences

Assoc. Prof. Mohammed Wadi (Vadi) PhD. in Electrical Engineering, Power Systems June 2017, Yildiz Technical University – Istanbul – Turkey, CGPA: AA

He has been ranked among the top 100,000 scientists globally, with a percentile rank in the top 2% in the field of Electrical and Electronics Engineering according to the Elsevier Data Repository published in 2024,

Department of Electrical & Electronics Engineering at Istanbul Sabahattin Zaim University (IZU), Istanbul, Turkey, Associate



Mohammed Wadi (Vadi)

SMART AND EFFICIENT INTEGRATION OF RENEWABLE ENERGY IN POWER SYSTEMS BASED ON AI

The efficient integration of renewable energy sources such as wind and photovoltaic (PV) power is essential for reducing greenhouse gas (GHG) emissions and advancing global sustainability goals. However, the increasing penetration of these variable energy sources poses challenges for grid stability, energy forecasting, and economic optimization. Artificial Intelligence (AI) offers powerful solutions for addressing these challenges through advanced prediction, adaptive control, and real-time decision-making. By utilizing machine learning and data-driven algorithms, AI enhances energy management, improves forecasting accuracy, and enables smarter grid operations. The economic and environmental benefits of combining AI with renewable energy include reduced operational costs, minimized carbon emissions, and enhanced energy efficiency. Real-world applications demonstrate AI's role in wind power forecasting, PV optimization, and intelligent demand-response systems. Looking ahead, AI-driven renewable integration will play a pivotal role in building resilient, low-carbon smart grids and accelerating the global transition toward sustainable energy systems.

Assoc. Prof. Dr. Nguyen Viet Thanh graduated PhD program in 2012 at Hohai University,

China, and he won an outstanding Ph.D. Candidate Award in 2013.

He is a Vice Dean of the Faculty of Civil Engineering,

University of Transport and Communications, Hanoi, Vietnam.



Nguyen Viet Thanh

GREENER SHIPPING, BRIGHTER FUTURE: FROM THE WORLD TO VIETNAM

Maritime transport, responsible for over 90% of global trade, is a significant contributor to greenhouse gas emissions. This keynote, "Greener Shipping, Brighter Future: From the World to Vietnam," analyzes international regulatory frameworks, Vietnam's current challenges, and its pathway toward maritime decarbonization. Despite ongoing initiatives in green port development—such as at Gemalink, Saigon Newport, and Hai Phong—Vietnam faces barriers in policy, technology, and infrastructure. Aligning with the IMO's Net-Zero Framework and the EU's "Fit for 55" package, Vietnam's national roadmap (Decision No. 876/QĐ-TTg, 2022) targets complete green energy adoption in shipping and ports by 2050. The study emphasizes innovation, alternative fuels, and cross-sector collaboration as key enablers of a sustainable and resilient maritime future.

Professeur des Universités / Full Professor
Directeur Adjoint de l'IUT de St-Nazaire
Institut Universitaire de Technologie de Saint-Nazaire
Département Génie Civil Construction Durable
Laboratoire GeM UMR-CNRS 6183



Nordine LEKLOU

VERS UNE NOUVELLE ÈRE DE LA CONSTRUCTION GRÂCE À LA FABRICATION ADDITIVE

L'impression 3D, ou fabrication additive, se positionne comme une technologie révolutionnaire dans l'industrie de la construction, offrant des solutions innovantes pour améliorer la productivité, réduire les coûts et promouvoir des méthodes de construction plus durables. Depuis les premières idées de fabrication additive en béton, le domaine a évolué avec des techniques comme l'extrusion, l'impression par projection, et des coffrages intelligents. Cependant, des défis importants restent à surmonter, notamment en ce qui concerne la régulation, l'intégration des renforts et la durabilité à long terme des structures imprimées. L'optimisation des matériaux, incluant l'utilisation de bétons éco-responsables, et les innovations technologiques promettent de transformer cette industrie. Cette présentation examine les avancées actuelles, les obstacles à l'adoption massive et les perspectives d'avenir de cette technologie dans le secteur de la construction.

3D printing, or additive manufacturing, is emerging as a revolutionary technology in the construction industry, providing innovative solutions to improve productivity, reduce costs, and promote more sustainable building methods. Since the early concepts of additive manufacturing in concrete, the field has evolved with techniques such as extrusion, projection printing, and smart formworks. However, significant challenges remain, particularly in regulation, reinforcement integration, and the long-term durability of printed structures. Optimizing materials, including the use of eco-friendly concretes, and technological innovations promise to transform the industry. This presentation explores the current advancements, barriers to widespread adoption, and future prospects of this technology within the construction sector.

Keywords: Additive Manufacturing - Concrete Structures- Sustainable construction - Building Technologies - Materials

Samir ALLAOUI
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Institut de Thermique, Mécanique, Matériaux (ITheMM – UR 7548)
Directeur adjoint de l'unité
Chaire Matériaux Architecturés (MATUR)
Responsable Master IC Parcours Mécanique, Matériaux et Procédés



Samir ALLAOUI

ADVANCED STRUCTURAL TEXTILE COMPOSITES FORMING AND INDUCED PROPERTIES

L'utilisation des composites pour les pièces structurales ne cesse de croître, notamment grâce à leur excellente performance massique. Ces pièces, souvent de géométrie complexe, posent cependant des défis importants en matière de mise en forme. De plus, les procédés de mise en forme influencent directement les propriétés finales des matériaux, ce qui ajoute une dimension critique à leur maîtrise. Cette présentation aborde la problématique de la mise en forme des pièces structurales en composites, en intégrant les avancées, les verrous actuels et les perspectives futures, tout en soulignant l'impact des procédés sur les propriétés induites.

"The use of composites for structural parts continues to grow, particularly due to their excellent specific performance. However, these parts, often with complex geometries, pose significant challenges in terms of shaping. Furthermore, the forming processes directly influence the final properties of the materials, adding a critical dimension to their mastery. This presentation addresses the issue of shaping structural composite parts, integrating recent advances, current challenges, and future prospects, while emphasizing the impact of processes on the induced properties."

Face to Face Presentation

Wednesday, 29 October 2025	Amphi	07:35	08:30	Technical Support & Information	
		08:30	08:45	ICESSE'25 and UMMTO Presentation: Moderator -Prof. HAMMOUM Hocine	
		08:45	08:55	Conference open: Prof.TAOUCHE-KHELOUI Fatma	
		08:55	09:05	Conference Introduction: Prof.ZOUAOUI Salah	
				Welcome greeting from the academic authorities-Prof Emeritus. BOUDA Ahmed	
		First plenary conference		Pr.Emeritus.BOUAFIA Y. (Chairman)•Pr.BOUTOUDJ S. •Pr.BILEK A.	
		09:10	09:45	Keynote Speaker Pr.NGUYENVIETTHANH	University of Transport and Communications, Hanoi, Vietnam Title:Greener shipping-abrighter future:from the world toVietnam
	Library room	09:45	10:20	Keynote Speaker Pr. VADI Mohammed	Istanbul Sabahattin Zaim University (IZU), Istanbul, Turkey. Title:Smart and Efficient Integration of Renewable Energy in Power Systems Based on AI
		10:30	10:55	Break-I (Coffee)+Poster session 1	
	Conferenceroom 01	First oral session-Civil Engineering-Structures		Pr.AITTAHAR K. (Chairman) •Pr.KAHILA. •Pr.HADJIL. •Pr.AITATMANEH.	
		Time	ID	Author	Title
		11:00	11:15	ICESSE2025-GC-STR-011	ABBACHE ALI The Nonlinear Response Of Functionally Graded Beams Using A Higher-Order Shear Deformation Theories In Post-Bucklin
		11:15	11:30	ICESSE2025-GC-STR-024	BENGRAB REDA Bending of Simply Supported FGM Porous Nano-Plates via HSDT:Under Combined Loading
		11:30	11:45	ICESSE2025-GC-STR-026	MRAIN SOHEIR Effect of Crack Characteristic son Natural Frequencies of Euler-Bernoulli Beams
		11:45	12:00	ICESSE2025-GC-STR-008	FRIH AHMED StabilityAnalysis of FGM Sandwich Nanoscale Plates in Hygro-Thermal Environment Using a New Four Variables Refined Plate Theory
	Library room	12:00	14:00	Break-II (Lunch)	
	Conferenceroom 01	Second oral session-Civil Engineering-Structures		Pr.KACHI MS.(Chairman) •Dr.LOUZAI A. •Pr.AITAMARMEZIANE M.	
		Time	ID	Author	Title
		14:00	14:15	ICESSE2025-SP-01	MOUKAH FAROUK Ecoquartier en Algérie entre ambition enviromrentale et réalité entrepreneuriale
		14:15	14:30	ICESSE2025-GC-STR-028	MOULOUD OUANANI Numerical Investigation of Soil-StructureInteraction Effects on the Seismic Performance of Box Girder Bridges
		14:30	14:45	ICESSE2025-GC-STR-012	GUERINE MOHAMMED HOUSSEM EDDINE Dynamic Behavior of Simply Supported CNT- Reinforced Plates
		14:45	15:00	ICESSE2025-GC-STR-004	LOUDNI NASSERDINE Prédiction of effective elastic properties of a RVE (Representative Volume Element) using Homogenization technique
	Library room	15:00	15:15	ICESSE2025-GC-STR-036	NGUYEN VIET THANH Dolphin Structures Health Monitoring a Case Study in HaiPhong,Vietnam
		15:30	16:00	Break-III(Coffee)+Poster session 2	
	Conferenceroom 01	Third oral session Civil Engineering-Structures		Pr.HADJ MELIANI M.(Chairman) •Dr.BENYAH K. •Dr.IDDIR A.	
		Time	ID	Author	Title
		16:00	16:15	ICESSE2025-SP-01	CHALAL KHALED Le Béton Cellulaire Léger pour Chapes: Stratégie d'Allègement Structurel et Optimisation Thermique
		16:15	16:30	ICESSE2025-GC-STR-002	LOUZAI AMAR Pushover-Based Evaluation of RC Frames with In fill Masonry under Seismic Loads
		16:30	16:45	ICESSE2025-GC-STR-019	HAMIZI MOHAND Stratégie de réhabilitation des structures de GénieCivil
		16:45	17:00	ICESSE2025-GC-STR-022	SMAHI REBIHA Principle of Homogenization Applied to Reinforced Concrete Structures

Wednesday, 29 October 2025	Conf erence room 02	First oral session-Civil Engineering-Materials				Pr.AITAIDER H.(Chairman) ●Pr.LEKLOU N. ●Dr.AITTALEB S.	
		Time		ID	Author	Title	
		11:00	11:15	ICESSE2025-GC-MAT-012	GUETTATFI LAMIA	Effect of Various Stabilizers on Water Absorption Resistance of Earth Concrete Using Soil from Ksar Moughel	
		11:15	11:30	ICESSE2025-GC-MAT-004	BOUZIANE ABDERREZAK	Use of Recycled Ceramic Waste as Partial Sand Replacement in Self-Compacting Concrete: Mechanical Performance and ANN Prediction	
		11:30	11:45	ICESSE2025-GC-MAT-009	MEZIANI MERIEM	Elaboration et caractérisation d'un plâtre éco-modifié à forte teneur en déchet plastique	
		11:45	12:00	ICESSE2025-GC-MAT-003	MAAMERI NOR EL-HOUDA	Propriétés mécaniques des bétons autoplaçants à base de déchets de béton et ajouts minéraux	
	Library room	12:00	14:00	Break			
	Conf erence room 02	First oral session-Civil Engineering-Environment				Pr.DAOUI A.(Chairman) ●Dr.ALI AHMED CH. ●Dr.AKMOUSSI O.	
		Time		ID	Author	Title	
		14:00	14:15	ICESSE2025-GC-STR-032	MOHAMED SEGHIR JABALLAH	Hybrid Structural Vibration Control:Digital PID Compared to Digital LQR	
		14:15	14:30	ICESSE2025-EE-CE-002	KHOUIDER ZAKIA	Decision support Tool for Financial Management of Sanitation Services in Algeria	
		14:30	14:45	ICESSE2025-EE-CE-007	LABDANI ABIR	Child-Centered Strategies for Urban Heat Island Mitigation: A Literature Review on Sustainable Design for Thermal Comfort	
		14:45	15:00	ICESSE2025-EE-CE-001	SAOUDI CHAHINAZ	Towards Circular and Economical WWT Psin Algeria:a model for optimizing operational performance	
		15:00	15:15	ICESSE2025-EE-CE-004	ZOULIKHA AIT LHADJ	Eléments vers une réconciliation avec l'environnement.Habiter est notre condition	
	Library room	15:30	16:00	Break-III (Coffee) + Poster session 2		Dr.BOUDLALO.(Chairman) ●Dr.ATLAOUI D. ●Dr.ALICHE A. ●Dr.BOUZEBODJA A ●Dr..AITBACHIR	
	Conf erence room 02	Second oral session-Civil Engineering-Materials				Pr.GHERNOUTI Y.(Chairman) ●Dr.KHELIL N. ●Dr.BOUZEBODJA F.	
		Time		ID	Author	Title	
		16:00	16:15	ICESSE2025-GC-MAT-034	ADEL MANI	Elaboration et caractérisation physico-mécanique d'un mortier destiné à la réparation et au renforcement des éléments structuraux en béton	
		16:15	16:30	ICESSE2025-GC-MAT-008	ANFAL DJAMED	Study of theSplittingTensile Bond Strength of Repair Mortars Based on Dune and Limestone Sands	
		16:30	16:45	ICESSE2025-GC-MAT-014	MERNIZ MOHAMED	Impact de la Combinaison de Fillers à Base de Déchets Industriels sur les Propriétés Physico-Mécaniques du Béton à Base de Sable Désertique	
		16:45	17:00	ICESSE2025-GC-MAT-029	SALIHA RABEHI	Flexible piezoelectric sensors: to wards intelligent,autonomous buildings	

Wednesday, 29 October 2025	Conferenceroom 03	First oral session-Energy Efficiency				Pr.BOUSSAFEURK.(Chairman) ●Pr.MAKHLOUFS .●DJEBOURIH.	
		Time		ID	Author	Title	
		11:00	11:15	ICESSE2025-EE-008	HAFIDHA MAOUEL	Influence de la Surface du Capteur solaire sur les Performances d’une Installation de roid Solaire	
		11:15	11:30	ICESSE2025-EE-021	BENCHALLAL RAFIK	Lubrication Analysis of Axi symmetric Squeeze Flowin Couple-Stress Fluids under Constant Squeeze Velocity	
		11:30	11:45	ICESSE2025-EE-016	CHAHRAZED MEBARKI	Assessing the Influence of Building Shape and Compactness on Energy Efficiency Using Energy Plus and BIM Workflow	
		11:45	12:00	ICESSE2025-EE-015	AZZOUG AMER	Les systèmes de gestion technique informatisée comme levier de l’efficacite énergétique dans l’espace residentiel en Algerie	
	Library room	12:00	14:00	Break			
	Conferenceroom 03	Second oral session-Energy Efficiency				● Pr.NEBBALI R.(Chairman) ●Dr.HAMZAOUI M.	
		Time		ID	Author	Title	
		14:00	14:15	ICESSE2025-EE-023	SAMIR MAMACHE	Thermo solutalin stability in rotating disc flow	
		14:15	14:30	ICESSE2025-EE-022	FAIZA BRAHIMI	Valorisation Energétique des Gaz d’Echappement des Turbines à Gaz : Vers une Amélioration de l'Efficacité et une Réduction des Emissions de CO ₂	
		14:30	14:45	ICESSE2025-EE-025	RADHIA DOUMANE	Simulation of the Impact of Glass Cracking and Dust Accumulation on the Performance Degradation of Photovoltaic Modules	
		14:45	15:00	ICESSE2025-EE-036	BRAHIM FERHAT	Solid-Fluid Flow Modeling and Simulation in Falling Particles-Based Solar Thermal Central Receiver	
		15:00	15:15	ICESSE2025-EE-012	AIT-CHEKDHIDH ZAINA	Enhanced Funnel Control Strategies for Wind Turbine Speed Regulation”FCA symmetric with scaling	
		15:15	15:30	ICESSE2025-EE-ME-018	KECIL I IDIR	Optimization of Battery Storage for a Grid-Connected PV System	
	Library room	15:30	16:00	Break–III (Coffee) + Poster session 2		Dr.BOUDDLAL O.(Chairman) ●Dr.ATLAOUI D. ●Dr.ALICHE A. ●Dr.BOUZEBOUDJA A ●Dr..AITBACHIR	
	Conferenceroom 03	Third oral session-Energy Efficiency				Pr.BOUTOUDJ M.(Chairman) ●Dr.AMOKRANE M . ●Pr.ZOUAOUI S.	
		Time		ID	Author	Title	
		16:00	16:15	ICESSE2025-EE-026	SOUAD KHEDACHE	Thermal Performance of Expanded Perlite/PCM21 Composites for Enhanced Building Envelope Inertia	
		16:15	16:30	ICESSE2025-EE-029	BOUSSAFEUR KACI	Simulation de l’effet combiné d’un jet et de la rotation d’un disque sur l’écoulement pariétal induit.	
		16:30	16:45	ICESSE2025-EE-031	HADJER MOHAMED	Contrôle Actif par Soufflage Continu de l'Ecoulement Turbulent Autour d’un Véhicule Simplifié de Type Corps d’Ahmed	
		16:45	17:00	ICESSE2025-EE-013	HAMZAOUI MALEK	Green refrigeration with CO2 at very low temperature by using the natural gas expansion	

Wednesday, 29 October 2025	Conf erence room 04	First oral session-Mechanical Engineering-Materials				Pr. ZAZI N.(Chairman) ●Dr.DJEBBALI S. ●Dr.NECHICHE M.				
		Time		ID	Author	Title				
		11:00	11:15	ICESSE2025-ME-022	KAHINA IGGUI	Preparation and Characterization of PHBV/Lignin Biocomposites				
		11:15	11:30	ICESSE2025-ME-028	SOUÂD MAKHFI	Experimental and Numerical Investigation of Damage Evolution in 7075 Aluminum Alloy Under Oligocyclic Fatigue				
		11:30	11:45	ICESSE2025-ME-032	ISHAK BERKANE	Study of the effect of the singularity of the fibre orientation angle in a perforated composite plate on an air craftwing				
		11:45	12:00	ICESSE2025-ME-007	HASSIBA HAMADACHE	Study of the Behavior of a Polyester/Chicken Feather Fiber Composite Under Thermal Stress				
	Library room	12:00	14:00	Break						
	Conf erence room 04	Second oral session-Mechanical Engineering- Materials				Pr.FERHOUM R. (Chairman)●Pr.ASMAF. ● KACIMIB. ●Dr. MENDILM.				
		Time		ID	Author	Title				
		14:00	14:15	ICESSE2025-ME-037	MOHAND AKLI AZZI	Evaluation Of a Natural Calcium Carbonate For Bone Substitution				
		14:15	14:30	ICESSE2025-ME-020	MOHAMED SAAD	Flambement des plaques composites polymères à gradient fonctionnel renforcées par des nanoplaquettes de graphène				
		14:30	14:45	ICESSE2025-EE-ME-020	ABDENOUR ELIAS	Olive biomass gasification-based power generation in the TiziOuzou region				
		14:45	15:00	ICESSE2025-ME-006	TAOUS DORIA ATMANI	Analyse Comparative entre Revêtements Multicouche et Monocouche: Essai deDureté				
		15:00	15:15	ICESSE2025-ME-001	HADJ-ALI YUCEF	Influence of a 3% NaCl Saline Medium on the Mechanical and Structural Properties of PDMS				
	Library room	15:30	16:00	Break –III (Coffee)+Poster session 2			Dr.BOU DLAL O.(Chairman) ●Dr.ATLAOUID. ● Dr.ALICHEA. ● Dr. BOUZEBODJA A ●Dr.AITBACHIR			
	Conf erence room 04	First oral session-Civil Engineering-Geotechnics				Pr.MELBOUCI B.(Chairman) ●Pr.BAHAR R. ●Pr.DJERBAL L.				
		Time		ID	Author	Title				
		16:00	16:15	ICESSE2025-GC-GEOT-016	BAZIZ KARIM	Parameters affecting the over turning resistance of geotechnical structures				
		16:15	16:30	ICESSE2025-GC-GEOT-024	HARIZI IMANE	Évaluation de la Vulnérabilité des Chaussées Bitumineuses Au Nord de l’Algérie Sous Chargements Dynamiques Et Sismiques				
		16:30	16:45	ICESSE2025-GC-GEOT-025	OUGUEMAT ALI	Comportement Hydromécanique D’une Argile Gonflante Compactée A Faible Teneur En Eau				
		16:45	17:00	ICESSE2025-GC-GEOT-026	MOBAREK HOURIA	Caractérisation géotechnique d’un sol par l’étude de ses niveaux de suctions				

Wednesday, 29 October 2025	Conferenceroom 05	First oral session-Hydraulic Engineering				Pr. HAMMOUM H.(Chairman) ●Pr. NGUYEN VIET THANH ●Pr. BERREKSI A. ●Dr. CHERIFI F.				
		Time		ID	Author	Title				
		11:00	11:15	ICESSE2025-HE-001	GOUFFI SAMIRA	Development of an Assessment Framework of Numerical Schemes Performance (DamBreak)				
		11:15	11:30	ICESSE2025-HE-004	TOUAZI LAMIA	Méthode de lax à pas fractionnaire pour la simulation d'un écoulement induit par la rupture d'un barrage				
		11:30	11:45	ICESSE2025-HE-016	DJIHAD HACHANI	Machine Learning Approaches for Daily Runoff Forecasting in Semi-Arid Regions: A Case Study of Oued Boukdir, Algeria				
		11:45	12:00	ICESSE2025-HE-008	BRAHIMI ABDELOUAHED	Évaluation expérimentale de l'influence de la rugosité sur la longueur du rouleau de surface d'un ressaut hydraulique en canal rectangulaire				
	Library room	12:00	14:00	Break						
	Conferenceroom 05	Second oral session-Hydraulic Engineering				Pr. KHATTAOUI M.(Chairman) ●Pr. REMINI B. ●Pr. MIHOUBI M. ●Dr. DEHMOUS H.				
		Time		ID	Author	Title				
		14:00	14:15	ICESSE2025-HE-005	MEHIRASOUAD	Physico-chemical analysis of aluminum hydroxide sludge from a treatment plant and its use as a sorbent for the removal of Congo red dye from aqueous solutions				
		14:15	14:30	ICESSE2025-HE-015	FATIHA LEBDIRI	Etude numérique d'infiltrations à travers la digue des barrages en terre				
		14:30	14:45	ICESSE2025-HE-018	SEGHIRI IMED TAKIEDDINE	Typologies des bassins hydrauliques de l'aqueduc antique de tiklat				
		14:45	15:00	ICESSE2025-HE-017	ALI BERREKSI	Calcul numérique du profil de la surface d'eau dans une transition hydraulique d'un coursier d'évacuateur de crue				
	15:00	15:15	ICESSE2025-HE-002	IGROUFAMERIE M	Rehabilitation Planning of the Drinking Water Supply Network: Case Study of Tizi-Ouzou, Algeria					
	Library room	15:30	16:00	Break –III (Coffee)+Poster session 2				Dr. BOUDDLAL O.(Chairman)●Dr. ATLAOUID. ● Dr. ALICHEA. ● Dr. BOUZBOUDJAA●Dr..AIT BACHIR		
	Conferenceroom 05	Second oral session- Mechanical Engineering- Environment				Pr. ABERKANEM.(Chairman)●Dr. BELTAGYH. ● Dr. HAMOUR M.				
		Time		ID	Author	Title				
		16:00	16:15	ICESSE2025-EE-ME-012	ABDELKADER MEKEME CHE	Comparative Albedo-Based Modeling of PERC+and BiCoRE Bifacial Solar Cells				
		16:15	16:30	ICESSE2025-EE-ME-022	HAMMOUCHE HAYAT	Exploring the variability of keratin composition for the design of sustainable acoustic insulators and humidity regulators				
		16:30	16:45	ICESSE2025-EE-ME-010	BELMIHOUB KHELLAF	Development of a composite material: raw earth,sand and olive pomace for use in sustainable construction				
		16:45	17:00	ICESSE2025-EE-ME-013	IDDIR BOUMRAR	Role of Privileged Angles for Wind Flow around Tall Buildings				

		Second plenary conference				Pr.HAMIZIM.(Chairman)●Pr.TAHAKOURTA.●Pr.CHELOUAHN.	
Amphi	09:00	09:35	Keynote Speaker 03: Pr. LEKLOU Nordine	Institut Universitaire de Technologie de Saint-Nazaire, Nantes, France.	Title: Vers une nouvelle ère de la construction grâce à la fabrication additive		
	09:35	10:10	Keynote Speaker 04: Pr. ALLAOUI Samir	Université de Reims Champagne-Ardenne, Reims, France.	Title: Advanced structural textile composites forming and induced properties		
Library room	10:10	10:50	Break–I(Coffee)+Poster session 3			Chairs:Pr.AMAOUZ N.(Chairman) ●Dr.TEBBICHE H. ●Dr.HANNACHI M.●Dr.BOUMRAR I. ●Dr.MEZIANI F.	
Conference room 01	Second oral session- Civil Engineering- Geotechnics					Dr.LOUADJ S.(Chairman) ●Dr.KHEFFACHE T. ●Dr.MEZIANI F.	
	Time		ID	Author	Title		
	10:55	11:10	ICESSE2025-GC-GEOT-011	BRARA ALI	Geotechnical isolation system to mitigate earth quake using rubber sand mixture		
	11:10	11:25	ICESSE2025-GC-GEOT-004	DERBANE SAID	Vibration response of a horizontal soil granular layer under harmonic excitation: A Discrete Element Modeling approach		
	11:25	11:40	ICESSE2025-GC-GEOT-010	ADJAL LEILA	Influence de la largeur de la bande renforcement et de l'angle du talus sur le renforcement superficiel d'une pente en sable		
	11:40	11:55	ICESSE2025-GC-GEOT-001	BENABDERRAHMANI SMAIL	Effect of soil behavior model on retaining wall deflection		
	11:55	12:10	ICESSE2025-EE-CE-011	BOULEMAREDJ ALI	INSUL software use for predictive assessment of acoustic insulation in partition walls against stair borne noise: Towards improved building acoustics in Algeria		
	12:10	12:25	ICESSE2025-GC-GEOT-023	LYLIADEGHOUL	Simulation Of The Behavior Of The Sidi Khelifa Dam During Construction And Filling		
	Conference room 02	First oral session-Mechanical Engineering- Structures					Pr.OULDOUALI M.(Chairman) ●Pr.BOURAS R. ●Dr.SLIMANI M. ●Dr.BELAID K.
Time		ID	Author	Title			
10:55		11:05	ICESSE2025-ME-009	MEGHLOUI BAHIA	Investigating Rheological Properties and Stability of Oil/Water Emulsions Under the Effect of Temperature and Oil Concentration		
11:05		11:15	ICESSE2025-ME-014	YASSINE BELHAOUI	The strain energy density factor in mode-I: The role of surface effects on crack propagation		
11:15		11:25	ICESSE2025-ME-038	HAMIDZENTOU	Machine Learning and Genetic Algorithm Optimisation of CO ₂ Uptake in Porous Organic Polymers		
11:25		11:40	ICESSE2025-ME-010	ZEDDAML OUKMANE	The Bacci and Bennati Problem with a Circular Crack In a Thin Elastic Medium		
11:40		11:55	ICESSE2025-ME-015	LEMOUSSI SOMIA	Finite element analysis of an intelligent mechanism using a piezoelectric material		
11:55		12:10	ICESSE2025-ME-011	GASMI KHALID	Multi-Objective Optimization of a Plastic Planetary Gear Pair Using the Marine Predators Algorithm		
12:10		12:25	ICESSE2025-ME-029	NAOUM HALIMA	Residual Stress Distribution Under Central Laser Peening: Comparative FEA of AA2024-T351 Full and Quarter Discs		
Conference room 01-Moderator: Prof. HAMMOUM Hocine					Closing ceremony & Lunch		

Poster Presentation

Wednesday, 29 October 2025	Library room	10:30 10:55	
	Poster session 1 - Civil Engineering		Pr. DAHMANI L. (Chairman) • Dr. BOUDJEMIA A. • Dr. ADJRAD A • Dr.SMAHI R. • Dr. GHOULEM K. • Dr.BOUAMRA Y.
	ID	Author	Title
	ICESSE2025-GC-STR-010	ALLALOU RANIA	Fire Design of Reinforced Concrete Bridge Decks According to Eurocode 2: A Case-Based Approach
	ICESSE2025-GC-STR-013	ZITOUNI MOHAMED RAFIK	Individual And Combined Effect of Parameters Influencing The Base Shear of Masonry-Infilled Frames
	ICESSE2025-GC-STR-035	LAZREG HADJI	Bending of Functionally Graded Polymer Composite Plates Reinforced with Graphene Nanoplatelets
	ICESSE2025-GC-STR-009	MEDDOUR MOHAMMED	Bending failure mechanisms of multilayered beams-based E-glass fibers waste: Experimental and numerical investigations
	ICESSE2025-GC-STR-029	ADNANE OURABAH	Impact of Design Parameters on the Confinement of Reinforced Concrete Beams
	ICESSE2025-GC-STR-037	SILVIA CALÒ	Numerical exploration of inorganic-based retrofit strategies for in-plane masonry behavior
	ICESSE2025-GC-STR-021	ABDELKADER SAFA	Influence of porosity on behaviour of functionally graded plates
	ICESSE2025-GC-STR-003	ASLI IMEN	Analyse mécanique des contraintes d'interface d'une poutre en béton armé poreuse renforcée par matériaux composites : effet de la précontrainte
	ICESSE2025-GC-GEOT-012	BAGHZIM HASSIBA	The effect of a model parameter on deformation
	ICESSE2025-GC-MAT-002	AZARRIH AMINA	Optimized Retention of Chromium (III) in Cementitious Composites with Activated Biochar
	ICESSE2025-GC-MAT-005	SLIMANOU HOUSAM	Effect of Replacing Quarry Sand with Alternative Materials, Including Brick Waste Sand, on the Mechanical Properties of Cement Mortars
	ICESSE2025-GC-MAT-006	DRAOUCHE KHAYRA	Influence de la Porosité et Des Conditions aux Limites sur le Comportement Dynamique des Plaques en Matériaux à Gradient Fonctionnel
	ICESSE2025-GC-MAT-024	FATIHA SOUIDI	Valorization of Pegmatite from Mekla region in the Manufacturing of Fired Clay Bricks Based on Local Clay
	ICESSE2025-GC-MAT-033	MEGROUS TASSADIT	Modification of the physical and thermal properties of plaster
	ICESSE2025-GC-MAT-035	KARTHIKEYAN RAJENDRAN	Influence of Sand-Coated Rubber Shreds on the Mechanical Properties of Concrete Incorporating Recycled Conveyor Belt Waste
	ICESSE2025-GC-MAT-013	DJELLOUL OMAR KOUIDER	Production des bétons autoplaçants écologiquement efficaces à base des granulats recyclés
	ICESSE2025-GC-MAT-020	LYLIA MEZIANE	Valorisation de la poudre de marbre comme substitut partiel au sable dans la formulation d'un mortier autoplaçant
	ICESSE2025-GC-MAT-036	LAMMARI MERIEM	Effect of Wood Sawdust Addition on Thermal Performance and Durability of Compressed and stabilized Earth Bricks
	ICESSE2025-GC-MAT-015	KAROUCHE ABDELHAMID	Manufacturing of Decorative Elements Using Lightweight Self-Compacting Concrete
	ICESSE2025-GC-MAT-007	LAFI DJAMEL EDDINE	Simplified quasi-3D modeling of buckling and bending behavior in functionally graded porous beams
	ICESSE2025-HE-003	BOURAGAA KHEIRA	Impact of Aperture Distribution on Particle Transport and Deposition in Fractured Media: A Numerical Study
	ICESSE2025-HE-012	HANANE AZIZA	Evaluation of Rainfall Erosivity Factor (R) Using Alternative Models: The case of Oued Isser watershed, Algeria
	ICESSE2025-HE-010	MEZHOUD CHERIFA	A hybrid mcdm approach for sanitation maintenance
	ICESSE2025-HE-021	SOUHILA BENKACI	Évaluation géospatiale du potentiel érosif par intégration du SPI et des dynamiques d'occupation du sol (cas du bassin versant d'Oued El Hachem)
	ICESSE2025-HE-013	BOUCHRAKI FAIZA	Analyse et amelioration de la distribution de l'eau potable dans la wilaya de bejaïa, algerie
	ICESSE2025-EE-CE-005	LILIA MAHIA	Vers des espaces extérieurs adaptés au vieillissement : effets croisés du climat et de l'environnement bâti
	ICESSE2025-EE-CE-010	HAMADI MERYEM	The Efficiency of Stiffeners on the Performance of Thin Square Clamped Plates under Concentrated Loading
	ICESSE2025-EE-CE-009	GRAÏNE HASSANE	Defense in depth concept and environmental impact study of a nuclear installation
	ICESSE2025-EE-CE-013	BOUDJELLALEL MOUATEZ BILLAH	Evaluating Raw Kaolin Clay as a Partial Substitute for Portland Cement in mortar
	ICESSE2025-GC-STR-027	SAMIRA SOUKANE	Diagnostic thermique du bâti colonial à Alger : apport de la thermographie infrarouge à la réhabilitation thermique
	ICESSE2025-GC-STR-016	ZAHIA ABDELLI	Seismic Damage Assessment of a Concrete Gravity Dam Considering Dam–Foundation Contact Using Nonlinear Pushover Analysis
	ICESSE2025-GC-GEOT-027	GUENDOUD MALIKA	Influence of tack coat on performance and durability of road structures

Wednesday, 29 October 2025	Library room	15:30 16:00	
	Poster session 2 - Civil Engineering		Dr. BOUDLAL O. (Chairman) • Dr. ATLAOUI D. • Dr. ALICHE A. • Dr. BOUZEBODJA A • Dr. AIT BACHIR
	ID	Author	Title
	ICESSE2025-GC-STR-033	LEYLA BOUZID	Impact of RPA 2024 on the seismic performance of an X-braced steel structure in Bejaia
	ICESSE2025-GC-STR-014	BOULIFA DJAFFAR	Modelling of the thermomechanical response of reinforced concrete under severe thermal loads
	ICESSE2025-GC-STR-017	FATIHA CHERIFI	Contribution des Voiles de Contreventement au Comportement Sismiques des Structures en Béton Armé
	ICESSE2025-GC-STR-020	MALIKA BELHOCINE	Comparative study of Finite Element Models of Reinforced Concrete Structural Elements
	ICESSE2025-GC-STR-023	HADJ AISSA BOUDJAMAA	Analyse non lineaire d'une section nervurée d'une passerelle piétonne en béton de haute performance
	ICESSE2025-GC-STR-025	OURIDA HELLAL SFAKSI	Behavior Factor and Ductility of Reinforced Masonry Structure in Horizontal Joints
	ICESSE2025-GC-STR-031	KAHINA HADDAD	Integrated Statistical and Computational Study of Bio-Based Multilayer GFRP Textile Beams under Bending
	ICESSE2025-GC-STR-034	AMAR ALICHE	Réservoirs métalliques face au ballonnement : analyse fiabiliste.
	ICESSE2025-GC-GEOT-015	BOUDJEMIA FAZIA	Study of the behavior of the land crossed by the Draa El Mizan tunnel (Tizi-Ouzou).
	ICESSE2025-GC-GEOT-005	HADJ ABDERRAHMANE SAIDA	Plastic Waste in Asphalt: A Sustainable Solution for Moisture-Resistant Pavements
	ICESSE2025-GC-GEOT-003	IDRES SADIA	Modeling the Tizi-Ouzou landslide
	ICESSE2025-GC-GEOT-018	BELMIHOUB HACENE	Improving the mechanical properties of a clay soil by adding waste rubber : direct box shear tests
	ICESSE2025-GC-GEOT-019	DYHIA IMRAZENE	Experimental numerical and statistical study of the degradation of marls under cyclical effects.
	ICESSE2025-GC-MAT-018	ALI AHMED CHAFIKA	The use of an eco-friendly material based on jute natural fibers in concrete reinforcement under axial compression: Experimental study and reliability analysis
	ICESSE2025-GC-MAT-019	NADIA BOUSSAA	Study of the Durability of Compressed Earth Bricks Stabilized with Biomass Ash
	ICESSE2025-GC-MAT-025	AIT TALEB SOUAD	Thermal and physical evaluation of glass fiber textile waste based-members with hollow cores
	ICESSE2025-GC-MAT-028	MALHA SALMI	Review of the effect of matrix composition on mechanical behavior of textile reinforced concrete
	ICESSE2025-GC-MAT-031	FARIDA RAHMANI	Effet de la poudre de granite sur le comportement rhéologique des pâtes cimentaires
	ICESSE2025-GC-MAT-032	FARIDA AMIAR	Performance evaluation of pervious concrete containing calcined mud under elevated temperatures
	ICESSE2025-GC-MAT-039	TOUFIF DJADOJUN	Modélisation du comportement mécanique d'un mortier de ciment à base de fibres cellulosiques.
	ICESSE2025-GC-MAT-038	FATMA BOUZEBODJA	Eco-Efficient High-Performance Mortar Based on Dune Sand: Punching Behavior Study
	ICESSE2025-HE-014	HAMANI SOFIANE	Numerical investigation of Free-Surface Flow in Channels with Geometric Transitions
	ICESSE2025-EE-CE-012	FERHAT SORAYA	Numerical Study of the Mechanical Behavior of Functionally Graded Beams under Bending
	ICESSE2025-EE-CE-003	AFIRI RYMA	Sustainable Material Management for Earth Dams: An Integrated Geotechnical and Environmental Approach
	ICESSE2025-EE-GEOT-021	HADADDENE NACIMA	Analysis of the liquefaction potential of an Algerian soil
	ICESSE2025-EE-GEOT-022	AMARA IDDIR	Study of the compaction behavior of shale-slag mixtures for road construction
	ICESSE2025-GC-MAT-21	ALLALA BAYA	An Advocated Numerical Model to Simulate the Constitutive Materials of Metal/Ceramic Bi-phased Beams
	ICESSE2025-GC-STR-040	LOUNACI LYNDA	Critical influence of pedestrian walkign speed on footbridge dynamic response
	ICESSE'25-GC-MAT-26	FALI SOUFYANE	Mechanical Characterization of Arundo donax-Based Bio-composites Matrix for Sustainable Construction
	ICESSE2025-ME-012	CHIKHAOUI IMANE	Capteur de gaz à base d'oxyde de cérium et son composite à 3 % de fibre de carbone

Thursday, 30 October 2025	Library room	09:55 10:55	
	Poster session 3 - Mechanical Engineering	Chairs: Pr. AMAOUZ N. (Chairman) • Dr. TEBBICHE H. • Dr. HANNACHI M. • Dr. BOUMRAR I. • DJEBOURI H. • Dr. MEZIANI F.	
	ID	Author	Title
	ICESSE2025-GC-GEOT-009	SEDIRA RIMA	Effect of granulometry on the compressibility of granular soils (case of dry sands)
	ICESSE2025-GC-GEOT-014	KHEFFACHE TOUFIK	Effet des caractéristiques d'élasticité sur la déformabilité d'un massif de sol lors de l'excavation d'un ouvrage souterrain
	ICESSE2025-EE-CE-008	REZIG WALID	Assessing Material Properties and Reuse Viability of Industrial Sludge in a Gas Complex
	ICESSE2025-EE-001	AIT TALEB BELKACEM	Optimizing Thermal Management: Hybrid Nanofluids, MHD Control, and Integrated Heat Transfer Analysis
	ICESSE2025-EE-032	HAREK MOHAMED	Magnetic Control of Heat Transfer in Natural Convection
	ICESSE2025-EE-034	WISSEM TIGHIDET	Effect of vertical baffle in liquid sloshing tank
	ICESSE2025-EE-018	SAHI FATIHA	Numerical modeling of the heat transfer within internal combustion engine valve's
	ICESSE2025-EE-005	MESSAOUDA GUEMMADI	Numerical study under fluent software and optimization of compact finned exchangers
	ICESSE2025-EE-014	CHAOUI ASSIL	Numerical Investigation of Innovative Shell and Tube Configurations: Improving Heat Transfer and Hydraulic Performance
	ICESSE2025-EE-030	MESSAOUDENE BOUALEM	Numerical analysis of the velocity profile during transient turbulent flow
	ICESSE2025-EE-ME-021	ABADA OMAR	Numerical simulation of the flow around bodies with different slits
	ICESSE2025-EE-ME-019	BENSEBA GHALIA	Comparison of the Properties of Mono-like, Monocrystalline, and Multicrystalline Silicon for Photovoltaic Applications
	ICESSE2025-EE-ME-023	SAMIRA OUSSIDHOUM	Surface Chemical Engineering for High-Efficiency Photovoltaic Cells: Mechanisms and Advances
	ICESSE2025-ME-004	KHERBA NESRINE	Study of the effects of rolling strain hardening on the aging of 7075 Aluminium alloy
	ICESSE2025-ME-021	MANEL BENMOHAMED	Surface Engineering of AA2024 by TSA Anodizing: Temperature-Controlled Optimization of Anodic Film Properties
	ICESSE2025-ME-027	ABDELBASSET GOUADRIA	Stress Intensity Factor for an External Crack in an Elastic Layer Subjected to Torsion by Two Coaxial Rigid Discs
	ICESSE2025-ME-036	IMENE BACHIR BEY	Fatigue Behavior of Multifunctional Composites with Embedded Metallic Inserts: Influence of Insert Thickness
	ICESSE2025-ME-030	LILLA MANSOURI	Analysis of the Influence of Recycled Fiber Content on the Mechanical Properties of a Polyester Resin
	ICESSE2025-ME-035	SAOUD EL ABDELMALEK	Structural and electrochemical study of cathode materials for protonic ceramic fuel cell (PCFC)
	ICESSE2025-ME-018	AMAR BOUEDJJA	Controlled optimization of heat treatments for 304L TRIP steel: Correlating processing parameters with microstructure and mechanical properties
	ICESSE2025-ME-019	MOKHTAR BENCHERIF	Experimental and Numerical Characterization of Springback in V-Bending of AISI 304L Stainless Steel
	ICESSE2025-ME-024	KAHINA AIMENE	Modélisation Numérique du Comportement des Mousses Élastomères pour la Conception de Coussins Orthopédiques
	ICESSE2025-ME-034	FATIHA TEKLAL	Etude du comportement à l'arrachement des interfaces fibre/matrice
	ICESSE2025-ME-039	KACIMI BACHIR	Comportement à l'impact faible vitesse des matériaux composites verre/polyester
	ICESSE2025-ME-002	BEN ABDESSELAM DJEDJIGA	Influence du champ magnetique sur la resistance a la corrosion de l'acier inoxydable 316L dans les solutions de chlorure de sodium contenant du glucose
	ICESSE2025-ME-040	ZAIDI ALI	Analyse de la qualité des perçages des matériaux composites verre/polyester.
	ICESSE2025-ME-016	MOUAS ZAHIRA	Free vibration Behavior of Functionally Graded Nanocomposite Plates Reinforced with Linear and Nonlinear Distributed Carbon Nanotube Nanofillers in Thermal Environment
	ICESSE2025-GC-GEOT-013	MERCHI AHMED	Influence of Column Length and Geosynthetic Reinforcement on the Bearing Behavior of Foundations on Compressible Soils
	ICESSE2025-HE-006	GHAITAOUI ESSAMA AHMED	DBD-Based Ozonated Water System for Fruit and Vegetable Washing: Performance Optimization and Quality Preservation
	ICESSE2025-GC-GEOT-020	RAHMANI NAIMA	Facteurs influant sur la stabilité des pentes et estimation de leur effet
	ICESSE2025-ME-017	KHOUS HANANE	Optimisation of the geometric parameters of a composite laminate
	ICESSE2025-EE-019	BOUTAGHANE MEHENI	Effects of radiation on instability in thermal stagnation point flow

Conferences

4. Civil Engineering

ICESSE2025-GC-STR-002

4.1 Pushover-Based Evaluation of RC Frames with Infill Masonry under Seismic Loads

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Abstract: Reinforced concrete (RC) frame structures are widely used in seismic regions due to their structural efficiency. In practice, these frames are often infilled with masonry walls, which are usually considered non-structural and neglected in seismic analysis. However, masonry infills can significantly alter the global seismic response by increasing stiffness, redistributing internal forces, and potentially causing undesirable failure mechanisms such as soft-story formation. This study investigates the influence of masonry infills on the seismic behavior of RC frames using a nonlinear pushover analysis. Two infill configurations are examined, along with three types of masonry materials defined by their compressive strength. The results highlight the dual role of infills—enhancing structural strength while potentially introducing vulnerability through stiffness irregularities. Special attention is given to identifying soft-story mechanisms. The study emphasizes the need to properly account for infill effects in seismic design to improve structural performance and safety.

Keywords: RC frame structures; Masonry infill; Pushover analysis; Seismic behavior.

ICESSE2025-GC-STR-003

4.2 Analyse mécanique des contraintes d'interface d'une poutre en béton armé poreuse renforcée par matériaux composites : effet de la précontrainte

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Résumé : En génie civil, la pathologie des structures consiste à identifier l'origine des dégradations et à proposer des solutions de réparation durables, nécessitant un diagnostic approfondi. Le choix des méthodes et matériaux de réparation est complexe, dépendant de la nature des désordres, des contraintes économiques et des particularités du site. Le renforcement ou la réparation repose sur l'ajout de matière aux zones trop sollicitées, soit par excès d'efforts (renforcement), soit par dégradation de la résistance (réparation). L'utilisation de matériaux composites collés pour le renforcement est prometteuse, mais le décollement de la plaque composite, dû à de fortes contraintes d'interface près des bords, constitue le défi majeur. Ce travail vise à une étude analytique des contraintes d'interface dans les poutres en béton armé poreuses renforcées par composites hybrides et voir les différents facteurs influençant sur le décollement de la plaque de renforcement.

Keywords : Poutre en béton armé ; Renforcement ; Matériaux composites ; Décollement.

ICESSE2025-GC-STR-004

4.3 Prédiction of effective elastic properties of a RVE (Representative Volume Element) using Homogenization technique.

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Abstract: The main objective of this work is to evaluate the effective properties of an Aluminum composite material containing a Boron inclusion, using numerical homogenization technique and the finite element method. Two models of Representative Volume Element (RVE) were used in this study: one containing a cylindrical inclusion and the other a prismatic inclusion oriented along the direction of one of the orthogonal axes of the global coordinate system. This study aims to determine the influence of the RVE scale effect on the obtained effective elastic properties, as well as the volume fraction of the inclusion. Analytical models were used to assess the numerical results.

Keywords: Composite; Homogenization; Numerical; Analytical.

ICESSE2025-GC-STR-008

4.4 Stability Analysis of FGM Sandwich Nanoscale Plates in Hygro-Thermal Environment Using a New Four Variables Refined Plate Theory.

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Abstract: The main interest of this work is to evaluate the performances of functionally graded material (FGM's) sandwich nanoscale plates under hygro-thermal conditions using a new refined plate theory. For that purpose, a new trigonometric transvers shear strain function (THSDT) is used and set to be compared with those which have been successfully used in various applications such as (TSDT); in aims to better predict the response of elements. For the buckling analysis of FG sandwich plates; the equations of motion are used and obtained from Virtual work's principle. The novelty of this formulation is the new proposed trigonometric transvers shear function (Kumar, 2019) which meets with the essential condition that the stresses becomes zero at the upper and lower surfaces of the "sandwich plate". To verify the validity of this work, the calculated results are compared with the ones in the literature. Comparison investigations reveal that the obtained results of the proposed formulation are approval in compare with those of other higher shear deformation theories (HSDT).

Keywords: FGM's sandwich plates; Hygro-thermal effect; Winkler–Pasternak elastic foundations.

ICESSE2025-GC-STR-009

4.5 Bending failure mechanisms of multilayered beams-based E-glass fibers waste: Experimental and numerical investigations

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Abstract: In this paper, a study is presented with the aim of verifying and comparing the experimental and numerical behavior of newly developed sandwich panels composed of a core, made from recycled glass fiber waste and polyester resin (GFRP), along with PVC face sheets. The originality of this work lies in its contribution to sustainable development through the reuse of glass fiber waste to design lightweight and environmentally friendly structural components. The panel cores were entirely manufactured using recycled glass waste. Subsequently, a series of multilayered panels with different fiber orientations were fabricated and tested under three-point bending to evaluate their flexural and shear performance. Moreover, a three-dimensional finite element model was developed in Abaqus, incorporating a Hashin damage criterion specifically designed for recycled polymer fibers. Additionally, the effects of core thickness and fiber orientation were investigated. The simulation results showed strong agreement with the experimental findings. Notably, increasing the core thickness significantly enhanced both the load-bearing capacity and stiffness of the beams. In contrast, variations in fiber orientation had a minimal effect on the bending behavior of the panels, confirming the durability of recycled glass-based multilayered structures for practical applications.

Keywords: *Experimental; Numerical; Environmentally; Simulation.*

ICESSE2025-GC-STR-010

4.6 Fire Design of Reinforced Concrete Bridge Decks According to Eurocode 2 : A Case-Based Approach

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Abstract: In civil engineering, ensuring the fire resistance of concrete structures is crucial for public safety and structural durability. This paper presents a simplified approach to designing a reinforced concrete bridge deck under fire conditions, based on Eurocode 2, Part 1-2. The study highlights the importance of incorporating fire scenarios in structural design and explains the impact of elevated temperatures on the mechanical properties of concrete and steel reinforcement. Using the tabulated method of Eurocode 2, we dimensioned key structural elements such as slabs, beams, and piers to meet fire resistance requirements. The study also emphasizes the conservative nature and ease of application of this method. While the method ensures compliance with safety regulations, its limitations for complex structures are discussed. This work contributes to promoting fire-resilient infrastructure through code-based and accessible design techniques.

Keywords: *Fire resistance; Reinforced concrete; Eurocode 2; Bridge deck.*

ICESSE2025-GC-STR-011

4.7 The Nonlinear Response of Functionally Graded Beams Using a Higher-Order Shear Deformation Theories in Post-Bucklin

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Abstract: In this paper, the nonlinear response of functionally graded beams (FGM) modeled according to higher-order shear deformation theories in post buckling is investigated, are presents an exact solution for the static postbuckling response of FGM beam. In the analytical formulation, a normal and shear deformations are considered by using the higher-order theories; the Hamilton's principle is coupled with a one mode Galerkin procedure for a simply supported beam. This paper presents an exact solution for the static postbuckling response. Results of this analysis show that classical and first-order theories underestimate the amplitude of postbuckling while all higher order theories

Keywords: Post buckling; FGM; shear deformation; Beam.

ICESSE2025-GC-STR-012

4.8 Dynamic Behavior of Simply Supported CNT-Reinforced Plates

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Abstract: This paper presents a comprehensive numerical solution for the free vibration analysis of functionally graded carbon nanotube-reinforced composite (FG-CNTRC) plates with simply supported boundary conditions. Based on a novel integral higher-order shear deformation theory with a hyperbolic warping function, the model accurately captures shear deformations using only four unknowns. Natural frequencies are obtained in closed form by applying Hamilton's principle and Navier's method, considering smoothly varying material properties through the thickness. The model's accuracy is validated against analytical and numerical results from the literature. A detailed parametric study examines the effects of carbon nanotube distribution, volume fraction, slenderness ratio, and geometry on the natural frequencies, confirming the model's effectiveness for optimizing high-performance composite structures.

Keywords: FG-CNTRC Plates; Free Vibration; simply supported boundary conditions; Higher-Order Shear Deformation Theory.

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4.9 Individual and Combined Effect of Parameters Influencing The Base Shear of Masonry-Infilled Frames

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Abstract: A prior global sensitivity analysis established that four parameters of the Crisafulli strut model—compressive strength (f_m), strut cross-sections (A_1 , A_2), and the strain at the residual section (e_2)—account for over 75% of the variability in the shear strength of infilled frames. However, this approach does not elucidate the nature of these influences (linear or nonlinear) or the potential synergy between parameters. This paper addresses this gap by employing a post-processing method based on a Morris experimental design. We characterize the form of each parameter's influence and visualize their interactions. The results show that f_m and A_1 exhibit nearly linear influences, while e_2 and A_2 display diminishing returns. Notably, a strong multiplicative interaction is observed between f_m and A_1 , demonstrating that maximum performance requires their combined action. Other interactions are weak, suggesting additive behavior. This work provides a deeper physical understanding, essential for optimized modeling and design.

Keywords: Parameter interactions; Crisafulli strut model; Masonry-infilled frames; Shear strength.

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4.10 Modelling of the thermomechanical response of reinforced concrete under severe thermal loads

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Abstract: In this study, a thermo mechanical modelling procedure using finite element software (CASTEM and ANSYS) is proposed to better understand the thermo mechanical behaviour of reinforced concrete structures. The initial and boundary conditions, as well as input parameters, are defined to examine the effect of temperature on stresses, displacements, and the impact of steel reinforcement on the deformation of a reinforced concrete beam. This work is part of a broader study on the durability of reinforced concrete structures exposed to elevated temperatures, particularly buildings located in the southern regions of our country. The main objective of this study is to develop a computational model for reinforced concrete elements subjected to both thermal and mechanical loads, taking into account the presence of reinforcement steel. Experimental results highlight the influence of temperature on the structural behavior.

Keywords: Concrete; Steel; Temperature; Thermomechanical behavior.

ICESSE2025-GC-STR-016

4.11 Seismic Damage Assessment of a Concrete Gravity Dam Considering Dam–Foundation Contact Using Nonlinear Pushover Analysis

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Abstract: This study investigates the seismic response of a gravity dam considering contact interaction at the dam-foundation interface. A 2D finite element model of the Beni Haroun dam was developed in CAST3M, and a nonlinear pushover analysis was performed under increasing seismic accelerations. The modelling includes uplift pressure, hydrodynamic effects using Westergaard's added mass approach, and three different damage models: RICRAG, MVM, and Mazars. Simulations were carried out with and without contact elements at the interface. Results show that introducing contact significantly delays damage initiation and alters its distribution, particularly at the foundation interface. These findings highlight the importance of including contact and choosing appropriate damage laws for reliable seismic assessment of gravity dams.

Keywords: Gravity dam; Seismic analysis; Damage model; Contact interaction; Finite element method.

ICESSE2025-GC-STR-017

4.12 Contribution des Voiles de Contreventement au Comportement Sismique des Structures en Béton Armé

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Résumé : La vulnérabilité sismique du bâti existant constitue un enjeu majeur dans de nombreuses zones urbaines. L'estimation des dommages sismiques et des risques associés implique la prise en compte de multiples facteurs, notamment l'intensité de l'aléa sismique local et les caractéristiques structurelles des constructions. Pour évaluer la vulnérabilité sismique du bâti de la ville de Tizi-Ouzou, nous avons constitué une base de données classant les bâtiments selon quatre critères fondamentaux : le niveau de conception parasismique, la hauteur de la structure, les matériaux de construction et la nature du système porteur. Dans cet article, nous nous intéressons particulièrement aux structures constituées de portiques et de voiles en béton armé. L'estimation des dommages sismiques repose sur une approche combinant l'analyse pushover pour générer les courbes de capacité, l'évaluation de l'aléa sismique, et la définition des points de performance. Les résultats indiquent que les structures ayant un niveau de conception parasismique faible à modéré présentent des déplacements au sommet élevés. Par ailleurs, des rotules de flexion, où des dommages structurels sont très limités, sont observées à la base des voiles.

Keywords : Vulnérabilité sismique ; Structures en portiques-voiles ; Méthode push-over ; Rotules plastiques.

ICESSE2025-GC-STR-019

4.13 Stratégie de réhabilitation des structures de Génie Civil

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Résumé : De nombreuses structures, déjà réalisées, ne répondent plus aux exigences des nouvelles règles parasismiques du règlement Algérien et cela pour différentes raisons. Soit ces structures ne sont pas du tout calculées au séisme. Soit ces structures sont calculées avec d'anciens règlements qui ne sont plus de vigueur aujourd'hui. Plusieurs bâtiments, conçus et réalisés par des organismes professionnels, ont subi des dommages irréversibles lors de séismes antécédents. Pour parer à ces dommages attendus, l'ingénieur est appelé à réhabiliter ces structures avant qu'elles ne subissent, de nouveau, ces efforts. L'approche proposée dans ce papier est (i) de quantifier et de réduire la vulnérabilité du bâti existant et (ii) d'évaluer l'action sismique attendue sur ces structures existantes. Cette stratégie nécessite des outils appropriés pour identifier la vulnérabilité des structures existantes (outil d'aide à la décision, système expert), d'évaluer l'action sismique attendue (conforme au RPA 2025) et de proposer des moyens (techniques) de réhabilitation dans des endroits justifiés et de rendre ces structures conformes à la nouvelle réglementation.

Keywords : *Stratégie ; Réhabilitation ; Structures ; Séisme.*

ICESSE2025-GC-STR-020

4.14 Comparative study of Finite Element Models of Reinforced Concrete Structural Elements

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Abstract: A computer program, "Beam 2 n," written in Fortran 90 language, has been improved, allowing the numerical simulation of straight sections based on two nodes beam finite element model formulated on the basis of Navier-Bernoulli theory. The objective is to formulate a three nodes finite element beam model by creating a new version of the "Beam 3n" program. A comparative study was then carried out to evaluate the performance of the model developed. The study revealed that three node beam elements offer significantly superior performance. Indeed, it is possible to obtain accurate results based on a more limited number of elements. This will help us to better handle the calculation of flat frames. However, it is necessary to refine the mesh adequately, particularly in the presence of strong non-linearities, to achieve satisfactory results.

Keywords: *Modelization; Simulation; Finite element.*

ICESSE2025-GC-STR-021

4.15 Influence of porosity on behaviour of functionally graded plates

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Abstract: The effect of porosity distribution pattern on the bending and free vibration analysis of porous FG plates is studied by using sinusoidal shear deformation theory. This theory accounts for sinusoidal variation of transverse shear strain through the depth of the plate and satisfies the zero traction boundary conditions on the surfaces of the plate without using shear correction factors. The material properties of the plate and the porosities within the plate are considered to vary continuously through the thickness direction according to the volume fraction of constituents defined by the modified rule of the mixture, this includes porosity volume fraction with four different types of porosity distribution over the cross-section. The governing partial differential equation of motion for the bending and free vibration analysis is obtained using sinusoidal shear deformation theory. An analytical solution is presented for the governing equation. Results of the presented solution are compared and validated by the available results in the literature. Moreover, the effects of material and porosity distribution and geometrical parameters on bending and free vibrational properties are investigated.

Keywords: *F G M; Free Vibration; Porosity; Hamilton's Principle.*

ICESSE2025-GC-STR-022

4.16 Principle of Homogenization Applied to Reinforced Concrete Structures

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Abstract: Three independent damage variables are derived and applied to the homogenized reinforced concrete material: a deviatoric variable, denoted “DdH,” and a volumetric variable, “DVH”; the third, “Da,” describes the symmetrical nonlinear behavior of steel. Consequently, the mechanical characteristics of the homogenized material—Young's modulus and Poisson's ratio—are considered as variables in the nonlinear domain. Thus, the developed model takes into account the confinement of the concrete, the shear and the percentage of steel, as well as the geometry of the reinforced concrete element. The ductility factor, expressed by the variable $a = \epsilon_{ft}/\epsilon_{rt}$, and the variation in Poisson's ratio significantly influence the model's results and reflect the actual behavior of reinforced concrete elements up to failure. In this study, we applied the established model to two beams subjected to three- and four-point bending, and the results obtained were very satisfactory.

Keywords: *Homogenization; Reinforced-Concrete; Damage; Nonlinear.*

ICESSE2025-GC-STR-023

4.17 Non-Linear Analysis of a Ribbed Section of a High-Performance

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Abstract: This paper presents a method for the non-linear analysis of a straight section of a reinforced concrete pedestrian bridge with variable geometry and heterogeneous material behavior. The concrete cross-section is defined by a succession of trapezoidal tables. The effect of tensile concrete after cracking is considered using the Grelat Model. Non-linearity will be considered from a mechanical point of view, in relation to the non-linear behavior of the materials in the ribbed section. A numerical calculation program in FORTRAN language is developed to simulate the non-linear behavior of the ribbed section up to failure. This program is used to determine the maximum capacity diagrams of the Moment-Curvature section ($M-\Phi$) that can support the section under the effect of a progressively loaded force (Step by Step). The numerical calculation results obtained and the comparison with numerical results show very good agreement.

Keywords: *Nonlinear Analysis; Foot-bridge; Capacity curve $M-\Phi$; Ductility.*

ICESSE2025-GC-STR-024

4.18 Bending of Simply Supported FGM Porous Nano-Plates via HSDT Under Combined Loading

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Abstract: This study investigates the bending behavior of simply supported rectangular porous nanoplates composed of functionally graded materials (FGMs) using Higher-Order Shear Deformation Theory (HSDT). The material properties vary continuously across the thickness according to a power-law distribution, with a pure ceramic top layer and a pure metal bottom layer. The analysis is conducted in two parts, Bending Response Under Mechanical Loading: The nanoplate is subjected to sinusoidal and uniformly distributed loads applied on its top surface. The HSDT formulation captures higher-order shear effects without requiring shear correction factors, providing an accurate prediction of displacements and stresses. Parametric Study on the Power-Law Exponent (η): The influence of the gradation index (η) on the nanoplate's deflection and stress distribution is systematically examined. Variations in η alter the material composition profile, affecting stiffness, deformation, and stress localization. The results provide insights into the optimal gradation of FGM nanoplates for enhanced mechanical performance, which is crucial for applications in nanotechnology, MEMS/NEMS, and advanced composite structures.

Keywords: *Functionally graded Nano-plates; Bending analysis; Ceramic-metal composites; Simply supported plates.*

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4.19 Behavior Factor and Ductility of Reinforced Masonry Structure in Horizontal Joints

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Abstract: The present work is based on the study of the behavior factor and ductility of reinforced masonry structures with reinforcement embedded in horizontal joints at each brick interface. These structures are excited by three accelerograms (El Centro, Charchell, and Kobe). A series of calculations was performed on two structures at different levels. Their design was carried out according to current rules and codes. They are subjected to vertical loads due to their own weights and horizontal loads due to seismic forces introduced by accelerograms. The study was carried out using the software Drain2D, based on the finite element method. The result is that the average value of the behavior factor and ductility is on the order of $q = \mu \approx 3$. This value is comparable to that given in the literature for reinforced concrete structures failing in flexion and comparable to that proposed in Eurocode 8 and confirmed by subsequent studies.

Keywords: *Reinforced masonry; Accelerograms; Behavior factor; Ductility.*

ICESSE2025-GC-STR-026

4.20 Effect of Crack Characteristics on Natural Frequencies of Euler-Bernoulli Beams

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Abstract: This study examines the influence of crack characteristics such as depth, Location, and orientation on the natural frequencies and mode shapes of Euler-Bernoulli beams. Using Finite Element Analysis (FEA) with ANSYS, the research analyzes how these factors affect Cantilever beam vibrations. The cracks are oriented at varying angles (90°, 75°, 60°, 45°, 30°) in different positions along a beam with a depth ratio between 0.1 and 0.6. Modal analysis is conducted for the first five natural frequencies, with particular attention to frequency shifts caused by crack-induced stiffness reductions. The results identify critical crack configurations that lead to significant decreases in natural frequencies, providing valuable insights for damage detection and structural health monitoring. This research enhances the understanding of crack dynamics and offers a comprehensive framework for assessing the vibrational behavior of cracked beams in real-world engineering applications.

Keywords: *Natural Frequency; Crack depth; Crack Location; Crack orientations; FEM Ansys.*

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4.21 Diagnostic thermique du bâti colonial à Alger : apport de la thermographie infrarouge.

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Abstract : L'Algérie dispose d'un important héritage architectural issu de la période coloniale française, caractérisé par une grande diversité stylistique et de fortes valeurs patrimoniales. Ce bâti ancien, bien qu'il façonne encore l'image urbaine des villes à noyau colonial, demeure un bâti énergivore. Conçu selon des principes aujourd'hui inadaptés et en l'absence de cadre réglementaire sur l'efficacité énergétique, ce bâti représente un défi majeur en matière de réhabilitation thermique. Cette contribution propose un diagnostic thermique, basé sur une campagne de thermographie infrarouge avec une caméra thermique Flir i7. Un ensemble d'immeubles du quartier emblématique Larbi Ben M'hidi a été évalué, selon la trilogie vitruvienne (*Firmitas, Utilitas, Venustas*), à l'issue de laquelle un cas d'étude représentatif a été retenu : l'immeuble 64 rue Larbi Ben M'hidi, pour lequel une campagne de thermographie infrarouge a été réalisée. L'analyse thermographique a mis en évidence plusieurs déperditions thermiques. L'étude ouvre des pistes pour une réhabilitation thermique respectueuse des spécificités architecturales et esthétiques de ce cadre bâti.

Keywords : Bati ancien ; Valeurs patrimoniales ; Thermographie infrarouge ; Diagnostic ; Rehabilitation thermique.

ICESSE2025-GC-STR-028

4.22 Numerical Investigation of Soil-Structure Interaction Effects on the Seismic Response of Expansion Joints and Lead Rubber Bearings in Isolated Box Girder Bridges

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Abstract: This study investigates the influence of Soil-Structure Interaction (SSI) on the seismic performance of an isolated box girder bridge (BGB) equipped with expansive joints and Lead Rubber Bearings (LRBs) at its supports. A detailed 3D nonlinear finite element model of the bridge is developed; incorporating three components of seismic excitation (horizontal and vertical components) to accurately capture the structural behaviour under multi-directional ground motions, while SSI effects are accounted for through spring-dashpot boundary conditions representing soil compliance. The nonlinear hysteretic response of the LRBs is explicitly modeled using bilinear force-displacement relationships, accounting for energy dissipation and recentering capabilities. Key findings highlight the critical role of bearing device design in mitigating seismic risks. Specifically, the study underscores that improperly designed LRB nonlinear characteristics can lead to restrainer failure, resulting in deck unseating and potential bridge collapse. Therefore, optimizing the hysteretic properties of isolation bearings is essential to ensure adequate displacement capacity and load redistribution, thereby enhancing the overall seismic resilience of MSSS bridges.

Keywords: Soil-Structure Interaction; Isolated MSSS bridge; Lead Rubber Bearings; Isolation bearings.

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4.23 Impact of Design Parameters on the Confinement of Reinforced Concrete Beams

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Abstract: This study conducts a thorough parametric analysis to explore how various design parameters affect the confinement of concrete through transverse reinforcement in reinforced concrete structures. Its principal focus is to understand how confinement influences structural strength, ductility, and energy absorption capacity. The research draws on experimental data from tests performed in Toronto, MECA, CEBTP, and Stuttgart, allowing for the formulation of trend curves that link the percentage of transverse reinforcement with performance indicators such as ultimate strength and ductility. These analytical findings form the basis for practical recommendations aimed at improving structural performance through more effective design strategies. By aligning the amount of transverse reinforcement with specific structural requirements, the study offers a more informed approach to the optimisation of reinforced concrete design, promoting safer and more efficient construction practices.

Keywords : Concrete confinement ; Transverse reinforcement ; Parametric analysis ; Trend curves.

ICESSE2025-GC-STR-031

4.24 Integrated Statistical and Computational Study of Bio-Based Multilayer GFRP Textile Beams under Bending

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Abstract: In this study, we present an integrated statistical and numerical optimization strategy for lightweight beams composed of glass fiber-reinforced polymer (GFRP) textile skins and a honeycomb core, all under uniform bending. By merging experimental data with finite element analyses (FEA), we evaluate both mechanical performance and structural efficiency. We apply response surface methodology (RSM) to investigate the key parameters, fiber orientation, textile type and stacking thickness, that govern load-bearing capacity and deflection. The optimization delivers substantial performance gains, enabling the design of lightweight, multilayer beams that preserve structural integrity while cutting material usage. Our results validate the influence of second-order interaction effects under bending loads and yield an optimal configuration for GFRP-based multilayer beams.

Keywords: GFRP-based beams; Optimization; Statistical modelling; FEA.

ICESSE2025-GC-STR-032

4.25 Hybrid Structural Vibration Control: Digital PID Compared to Digital LQR

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Abstract: In recent years, the idea of using hybrid control systems to dampen structural vibrations, especially those caused by earthquakes, has really captured the attention of many researchers. This article delves into how effective two digital controllers—a Digital LQR (linear quadratic regulator) and a digital PID (Proportional–integral–derivative) controller are at generating the necessary control force for active dampers. Our structural model incorporates both an active tuned mass damper (ATMD) and base isolators. When we look at the simulation results, it becomes clear that the digital LQR controller is remarkably better at reducing the structure's response compared to its digital PID counterpart.

Keywords: Structural vibration control; Active tuned mass damper; Hybrid control; Digital PID Control; Digital LQR Control.

ICESSE2025-GC-STR-033

4.26 Impact of RPA 2024 on the seismic performance of an X-braced steel structure in Béjaïa

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Abstract: In January 2024, a new Algerian Seismic Code (RPA 2024) was published, introducing changes and methods not present in RPA 99/2003. Notably, the seismic zoning of Béjaïa shifted from medium (IIa) to high (VI). Given the region's frequent seismic activity, urban buildings continue to face considerable vulnerability. Despite the mechanical advantages of steel, it remains underutilised in Algerian construction. This study assesses a steel structure with X-bracing in Béjaïa using nonlinear static pushover analysis under both RPA 99/2003 and RPA 2024 spectra. The results reveal a significant difference in performance points and local plasticity between the two codes.

Keywords: X-braces structure; RPA 2024 spectra; Nonlinear static pushover analysis; Seismic performance.

ICESSE2025-GC-STR-034

4.27 Réservoirs métalliques face au ballonnement : analyse fiabiliste.

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Abstract : Ce travail de recherche s'inscrit dans le domaine de l'ingénierie sismique appliquée aux réservoirs métalliques de stockage. Il porte spécifiquement sur l'analyse probabiliste du comportement de ces structures soumises à des sollicitations sismiques, avec une attention particulière portée au phénomène de ballonnement, également appelé effet de vague. Ce phénomène dynamique, résultant de l'interaction entre le liquide contenu et les mouvements sismiques de la cuve, peut engendrer des sollicitations importantes sur les parois du réservoir et compromettre sa stabilité. L'objectif principal de l'étude est d'estimer la probabilité de défaillance du réservoir due au ballonnement, en tenant compte des incertitudes inhérentes à l'aléa sismique. Pour ce faire, une approche probabiliste est adoptée, permettant d'intégrer la variabilité des paramètres et de fournir une évaluation plus réaliste et fiable de la sécurité structurale. L'ensemble de l'analyse est menée dans le respect des exigences du Règlement Parasismique Algérien (RPA 2024), en utilisant des méthodes modernes d'évaluation du risque et de simulation numérique.

Keywords : Réservoir métallique ; Ballonnement ; Approche probabiliste ; Fiabilité.

ICESSE2025-GC-STR-035

4.28 Bending of Functionally Graded Polymer Composite Plates Reinforced with Graphene Nanoplatelets

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Abstract: This work investigates the bending behavior of functionally graded multilayer graphene nanoplatelet (GPL)/polymer composite plates using a newly proposed n-order refined plate theory. The theory introduces a higher-order polynomial displacement field that ensures variational consistency and eliminates the need for shear correction factors. A key innovation of this work lies in the layer-wise variation of GPL weight fractions, enabling the design of functionally graded nanocomposites with both uniform and non-uniform reinforcement patterns—specifically, UD, FG-O, FG-X, and FG-A. While most existing studies are limited to uniformly distributed GPLs or rely on lower-order theories, this study addresses these limitations by proposing an analytically tractable higher-order model that can accurately capture shear deformation effects and by systematically analyzing the mechanical influence of different GPL distribution patterns. This dual advancement fills an important gap in the literature, particularly in understanding the performance of non-uniformly graded nanocomposites under bending.

Keywords: Graphene nanoplatelets (GPLs); Nanocomposite plates; Functionally graded nanocomposites; Polymer composites.

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4.29 Dolphin Structures Health Monitoring: A Case Study in Hai Phong, Vietnam

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Abstract: This paper focuses on assessing a deteriorated dolphin structure in Hai Phong Vietnam, aiming to evaluate its current technical condition and structural integrity. The study adopts a multi-stage methodology combining visual inspection, dynamic response measurement, and numerical analysis. The findings revealed a considerable reduction in load-bearing capacity, classifying the dolphin as severely degraded according to international standards. The study demonstrates the effectiveness of integrating on-site inspection, vibration testing, and numerical modelling to provide a comprehensive evaluation framework for port structure health assessment.

Keywords: Dolphin structure; Health monitoring; Vibration; Frequency.

ICESSE2025-GC-STR-037

4.30 Numerical Exploration of Inorganic-Based Retrofit Strategies for In-Plane Masonry Behavior

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Abstract: The retrofitting of masonry walls using inorganic-based composite systems, such as Fabric-Reinforced Cementitious Matrix (FRCM), Composite Reinforced Mortar (CRM), and Steel Reinforced Grout (SRG), has emerged as a promising solution for enhancing structural performance, particularly in heritage contexts where material compatibility, durability, and fire resistance are critical. Despite growing experimental evidence supporting their effectiveness in improving in-plane behavior, the exploitation factor (defined as the ratio between the actual contribution of the reinforcing fabric and its theoretical maximum capacity) remains insufficiently characterized, especially under in-plane shear conditions. This study presents a comprehensive numerical investigation into the exploitation factor of inorganic strengthening systems applied to masonry walls. Finite Element Models (FEMs) were developed to simulate the nonlinear shear response of masonry assemblies, incorporating detailed representations of masonry units, mortar joints, and composite layers. Following rigorous model calibration using proprietary experimental data, a series of parametric analyses were conducted to assess the influence of textile type, matrix stiffness, and application configuration on the mobilization of reinforcement capacity. Results reveal that the exploitation factor is highly sensitive to the mechanical compatibility between matrix and fabric.

ICESSE2025-GC-STR-040

4.31 Critical Influence of Pedestrian Walking Speed on Footbridge Dynamic Response

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Abstract: Urban footbridges, essential for sustainable cities, must mitigate vibrations amplified by pedestrian speed. When step frequency; directly linked to walking speed; coincides with the structure's natural frequency, resonance occurs as dramatically demonstrated by the London Millennium Bridge. This phenomenon multiplies oscillations, compromising safety and comfort (Dallard et al., 2001; Garcia et al., 2022). Our research reveals pedestrian speed governs this risk. Through dynamic modelling and simulations, we demonstrate that higher speeds ($v > 1.0$ m/s) increase resonance probability by 60% on fundamental modes. Vibration amplitudes can quintuple, exceeding critical thresholds. The analysis identifies high-risk speed ranges requiring targeted interventions: Pedestrian flow moderation via integrated urban features. Dampers optimized for speed-excited frequencies. This preventive approach enhances infrastructure resilience against dynamic interactions, where speed emerges as the priority controllable parameter.

Keywords: *Footbridge; Pedestrian's velocity; Damping; Comfort.*

ICESSE2025-GC-MAT-002

4.32 Optimized Retention of Chromium (III) in Cementitious Composites with Activated Biochar

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Abstract: The immobilization of heavy metals in cementitious materials is essential for sustainable construction and environmental protection. This study investigates the enhancement of chromium (III) immobilization by adding activated biochar to cement-based materials. The effect of 5% contaminated (MC5) and uncontaminated (M5) activated biochar on the mechanical properties of cement mortars was analyzed through compressive and flexural tests, FTIR, and XRD. The results showed that at 3, 7, and 28 days, the compressive and flexural strengths of the biochar-added mixtures reached 20.9 MPa, with M5 and M5C exhibiting 28.23% higher compressive strength than ordinary mortar (OM). Activation of biochar improved its surface area and porosity, enhancing its ability to adsorb heavy metals. This improved adsorption capacity is key to effective heavy metal immobilization in cementitious materials, which contributes to both the durability of construction materials and environmental safety. Using activated biochar is thus a promising strategy for sustainable building and reducing heavy metal contamination.

Keywords: Heavy metals; Immobilisation; Chromium III; Activated biochar; Cementitious material.

ICESSE2025-GC-MAT-003

4.33 Propriétés mécaniques des bétons autoplaçants à base de déchets de béton et ajouts minéraux

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Résumé: Les principaux problèmes liés à l'environnement sont l'épuisement des ressources naturelles, les émissions en CO₂ et la mise en décharge des déchets. L'utilisation des ajouts cimentaires, des granulats recyclés (GR) et des fibres d'acier recyclées (FAR) issues des pneus usés peut contribuer à résoudre ce problème. Cette recherche a pour but d'évaluer les performances mécaniques d'une fraction volumique de 0 à 0.8% de FAR sur les performances de béton autoplaçant à base de GR (BAPR). Les résultats ont montré l'effet bénéfique des fibres sur la résistance à la compression et à la flexion.

Keywords : Béton autoplaçant; Granulats recyclés; Fibres d'acier recyclées; Résistance.

ICESSE2025-GC-MAT-004

4.34 Use of Recycled Ceramic Waste as Partial Sand Replacement in Self-Compacting Concrete: Mechanical Performance and ANN Prediction

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Abstract: This study investigates the potential of valorizing ceramic waste as a partial replacement for sand in the production of self-compacting concrete (SCC). Several SCC mixtures were formulated by substituting a portion of natural sand with finely crushed ceramic waste. The influence of this substitution on the fresh and hardened properties of SCC was assessed, particularly focusing on workability and compressive strength. The experimental data were also used to train an artificial neural network model for predicting compressive strength based on the ceramic content in the sand fraction. The results indicate that incorporating ceramic waste as a sand substitute is technically viable, yielding SCC with adequate mechanical performance and satisfactory flowability. This approach not only contributes to reducing natural sand consumption but also offers a sustainable solution for managing ceramic waste. Furthermore, the neural network model demonstrated high predictive accuracy, confirming its effectiveness as a tool for forecasting the compressive strength of SCC with recycled ceramic sand. Overall, the study highlights the environmental and technical benefits of integrating ceramic waste into SCC by replacing part of the sand component.

Keywords: Self-compacting concrete; Recycled ceramic sand; Artificial neural network; Prediction; Compressive strength.

ICESSE2025-GC-MAT-005

4.35 Effect of Replacing Quarry Sand with Alternative Materials, Including Brick Waste Sand, on the Mechanical Properties of Cement Mortars

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Abstract: The conventional sourcing of sand for cementitious materials primarily involves the crushing of limestone rocks, a method that incurs high costs and poses considerable environmental challenges, including ecosystem degradation and the overexploitation of natural resources. To mitigate these issues and promote sustainability, it is crucial to investigate alternative sources such as dune sands and the recycling of brick waste. Brick waste can be processed into fine sand through crushing and sieving, thus offering renewable and eco-friendly materials. This study focuses on optimizing a mortar formulation that utilizes quarry sand, with a partial replacement by these alternative sands. The incorporation of these alternative sands yields satisfactory mechanical properties. Notably, the highest compressive and flexural strengths were recorded in mortars composed of a blend of brick sand and dune sand. These findings underscore the potential of this approach as a sustainable and economically viable alternative to traditional sand sourcing in cementitious material.

Keywords: Mortar; Sand; Brick; Compression and Flexural.

ICESSE2025-GC-MAT-006

4.36 Influence de la Porosité et Des Conditions aux Limites sur le Comportement Dynamique des Plaques en Matériaux à Gradient Fonctionnel

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Résumé : Cette étude porte sur l'influence des défauts, notamment les porosités, pouvant apparaître lors du processus de fabrication des plaques en matériaux fonctionnellement gradués (FGM). L'objectif principal est d'examiner les caractéristiques de vibration libre des plaques FGM poreuses en fonction de différents types de compositions matérielles. La variation du module de Young selon l'épaisseur de la plaque est modélisée à l'aide d'une loi de puissance, tandis que le coefficient de Poisson est supposé constant. Différentes formes de gradation du matériau sont analysées, et la précision du modèle proposé est évaluée à travers une analyse comparative. De plus, la recherche explore l'impact des variations du taux de distribution de la porosité, des types de gradation, de l'indice de la loi de puissance et du rapport d'épaisseur sur la fréquence fondamentale des plaques.

Keywords: *Vibration libre ; Matériaux fonctionnellement gradués ; Taux de distribution de la porosité.*

ICESSE2025-GC-MAT-007

4.37 Simplified quasi-3D modeling of buckling and bending behavior in functionally graded porous beams

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Abstract: This paper introduces an innovative quasi-3D approach for analyzing buckling and static bending of porous functionally graded beams. The formulation combines higher-order shear deformation theory with a simplified integral scheme, enabling accurate modeling while reducing computational complexity. The method naturally accounts for thickness stretching effects and satisfies shear boundary conditions without correction factors. Equilibrium equations are derived through the virtual work principle and solved analytically for various loading and boundary conditions. Results show excellent agreement with existing solutions while highlighting the critical influence of pore distribution, material gradient and geometric parameters on structural response. The proposed approach provides an efficient tool for designing and optimizing advanced composite structures, particularly suitable for preliminary engineering analysis where balance between accuracy and simplicity is crucial.

Keywords: *Higher-order shear deformation theory; FG beam; Integral Quasi-3D; Porosity.*

ICESSE2025-GC-MAT-008

4.38 Study of the Splitting Tensile Bond Strength of Repair Mortars Based on Dune and Limestone Sands

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Abstract: The present paper aims to study the mechanical properties and the splitting tensile bond strength of repair mortars reinforced with vegetable fibers. Cubic specimens (10×10×10 cm³) were tested using the indirect tensile splitting method to assess the bond strength between the substrate concrete and repair mortars. The mortars were prepared with cement, marble powder, sand, water, superplasticizer, and vegetable fibers of varying lengths (5 mm, 10 mm, and 20 mm). Results demonstrate that fiber reinforcement improves the flexural strength of the mortars. However, the addition of fibers negatively impacted the compressive strength. Overall, the incorporation of vegetable fibers enhanced the bond performance between the repair material and the existing concrete substrate. Among all mixes, the mortar with 5 mm fibers (MR5) exhibited the highest bond strength at the interface with the substrate concrete.

Keywords: *Repair mortar; Vegetable fibers; Mechanical properties; Splitting tensile.*

ICESSE2025-GC-MAT-009

4.39 Elaboration et caractérisation d'un plâtre éco-modifié à forte teneur en déchet plastique

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Résumé : Les chercheurs en génie civil s'efforcent de transformer les déchets industriels en matériaux de construction durables, afin de limiter les impacts environnementaux et de répondre aux nouvelles exigences du secteur. Dans ce cadre, cette étude vise à valoriser un déchet polymère plastique comme substitut partiel au plâtre. Des formulations ont été élaborées avec des taux de remplacement élevés (50 %, 70 % et 90 %) à base de broyat de déchets polymère. L'objectif est d'évaluer l'impact de cette substitution sur les propriétés physiques, mécaniques et thermiques du plâtre pris. Les essais réalisés comprennent la résistance à la flexion et à la compression, la porosité ouverte, l'absorption d'eau, la rétention d'eau, la capacité tampon hydrique et la conductivité thermique. Les résultats ont montré une diminution significative de la conductivité thermique, associée à une capacité tampon hydrique modérée. Une augmentation de la porosité et de l'absorption d'eau affectant négativement les performances mécaniques.

Keywords : Déchets polymère ; Plâtre éco-modifié ; Matériau composite.

ICESSE2025-GC-MAT-012-

4.40 Effect of Various Stabilizers on Water Absorption Resistance of Earth Concrete Using Soil from Ksar Moughel

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Abstract: Driven by environmental concerns and the shift toward sustainable construction, interest in earth-based materials has grown due to their ecological and economic advantages. In Algeria, earth has traditionally been used, particularly in Ksour construction. However, its vulnerability to water remains a major limitation. This study investigates the impact of quicklime and Portland cement, in varying contents and combinations, on the water absorption resistance of earth concrete made with soil from the degraded area of Ksar Moughel. Capillary and total water absorption tests show that both stabilizers improve water resistance, with quicklime yielding the best performance.

Keywords: Stabilized Earth Concrete; Chemical Stabilizers; Water Absorption.

ICESSE2025-GC-MAT-013

4.41 Production des bétons autoplaçants écologiquement efficaces à base des granulats recyclés

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Résumé : La protection de l'environnement est devenue une priorité majeure ces dernières années. Les déchets industriels déposés en décharge sont généralement incinérés, ce qui engendre des effets néfastes sur l'environnement. En revanche, le recyclage des bétons de démolition peut offrir des avantages significatifs et des solutions pertinentes pour la protection de l'environnement, tout en constituant une source supplémentaire importante de granulats. Nous avons donc étudié le comportement rhéologique des bétons autoplaçant (BAP) contenant des gros et fins granulats recyclés. Des essais à l'état frais ont été réalisés à l'aide des essais de l'étalement, le temps d'écoulement en entonnoir en V, l'essai à la boîte en L (L-Box) et l'essai au tamis. Les résultats des essais expérimentaux ont montré que la substitution des gros et fins granulats recyclés jusqu'à 50% améliore l'ouvrabilité et par conséquent diminue la viscosité plastique et le seuil de cisaillement des BAP.

Keywords : Béton autoplaçant; Granulats Recyclés; Ouvrabilité; Rhéologie.

ICESSE2025-GC-MAT-014

4.42 Impact de la Combinaison de Fillers à Base de Déchets Industriels sur les Propriétés Physico-Mécaniques du Béton à Base de Sable Désertique

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Abstract : Dans cette étude, l'effet du remplacement partiel des composants du filler, en particulier le calcaire (LF), par deux types de déchets en poudre — la poudre de verre (WGP) et la perlite expansée (WEP) — dans le béton de sable de désert (DSC) est examiné. La technique du plan d'expériences (DOE) a été utilisée pour évaluer l'influence de ces substitutions sur les propriétés du DSC. L'étude se concentre sur la densité à l'état durci et la résistance à la compression après 28 jours. Les résultats montrent que la combinaison de WGP et de LF permet d'obtenir une bonne compacité et améliore la résistance à la compression. L'ajout de WEP a entraîné une légère diminution de la densité et de la résistance, tout en restant dans des limites acceptables. Ces résultats suggèrent une utilisation durable du sable de désert et des matériaux recyclés, contribuant à réduire les déchets, à valoriser les ressources locales et à promouvoir une construction plus écologique.

Keywords : Béton de sable du désert ; Poudre de verre ; expansée.

ICESSE2025-GC-MAT-015

4.43 Manufacturing of Decorative Elements Using Lightweight Self-Compacting Concrete

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Abstract: This study explores the potential of lightweight self-compacting concrete (SCC) for the fabrication of decorative architectural elements. The aim is to combine the aesthetic versatility of concrete with improved handling and performance characteristics provided by SCC technology. By incorporating lightweight aggregates, the density of the concrete is significantly reduced, which facilitates easier installation and reduces structural load. The self-compacting properties ensure excellent mold filling and surface finish without the need for vibration, making it ideal for producing intricate decorative shapes. The paper examines the mix design, mechanical properties, workability, and surface quality of lightweight SCC tailored for non-structural decorative applications. The results demonstrate that lightweight SCC can be effectively used to create high-quality, visually appealing, and durable decorative elements, offering a sustainable and efficient alternative for modern architectural design.

Keywords: Self-Compacting Concrete (SCC); Decorative Elements; Lightweight Aggregates; Concrete Molding.

ICESSE2025-GC-MAT-018

4.44 The use of an eco-friendly material based on jute natural fibers in concrete reinforcement under axial compression: Experimental study and reliability analysis

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Abstract: The synthetic fiber industry used in composite materials for concrete reinforcement is a polluting industry. More environmentally friendly solutions are therefore desired to protect our environment. In this context, this study aims to assess the ability of natural jute fibers to replace glass fibers in the compression reinforcement of concrete cylinders. The reinforcement highlighted consists of fiber reinforced polymer (FRP) strips bonded in a helical pattern. An experiment involving cylindrical test specimens (Ø15cm×30 cm) was conducted in the laboratory. A total of 21 concrete cylinders were manufactured in order to evaluate the jute FRP performances in comparison with those of glass FRP, by varying the strips width and their number of turns. The results shown that replacement of glass fibers by jute ones in concrete reinforcement, may be possible. Finally, the inherent randomness of the variables governing the studied system highlights the accuracy and reliability of the proposed design.

Keywords: Jute spiral- FRP; Concrete reinforcement; Reliability analysis; Compressive strength.

ICESSE2025-GC-MAT-019

4.45 Study of the Durability of Compressed Earth Bricks Stabilized with Biomass Ash

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Abstract: There is considerable interest in the use of biomass waste in soil stabilization because of its technical, environmental, economic, and social benefits. In this context, this research aims to valorize biomass ash as a physicochemical stabilizer and to investigate its effects on durability, in particular on the sensitivity of materials to water in compressed earth bricks after 7, 28, 60 and 180 days under laboratory ambient conditions with different biomass ash (BA) contents (0,5, 10, 15 and 20% by weight). A capillary water absorption test evaluated the durability performance. The results showed that increasing the BA content from 10% to 20% in partial soil replacement leads to an improvement in the durability of the bricks for 7 to 60 days. The study concluded that an ash replacement rate of 20% represents the optimal biomass ash content in the composite studied, both in terms of water resistance and overall performance.

Keywords: Biomass ash; Compressed earth bricks; Durability performance; Capillary water absorption.

ICESSE2025-GC-MAT-020

4.46 Valorisation de la poudre de marbre comme substitut partiel au sable dans la formulation d'un mortier autoplaçant

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Résumé : Ce travail a pour objectif d'explorer le potentiel de développement d'un mortier autoplaçant (MAP) à travers la valorisation de coproduits industriels, en particulier les résidus calcaires issus des carrières et les déchets de marbre. L'étude porte plus précisément sur l'incorporation de la poudre de marbre (PM) en remplacement partiel du sable calcaire provenant de l'industrie de concassage, selon des taux de substitution de 7 %, 12 %, 17 %, 22 % et 25 %, afin d'évaluer son influence sur les propriétés du mortier à l'état frais et durci. Les propriétés à l'état frais, évaluées par les essais d'étalement au mini-cône et d'écoulement au V-funnel, montrent que l'ajout de PM augmente le diamètre d'étalement et le temps d'écoulement, traduisant une modification du comportement rhéologique. Sur le plan mécanique, les résistances à la compression s'améliorent avec l'augmentation du taux de substitution, et la résistance à traction maximale observée à 22 %, indiquant un seuil optimal.

Keywords : Mortier autoplaçant ; Valorisation ; Coproduits industriels ; Déchets calcaires et de marbre.

ICESSE2025-GC-MAT-021

4.47 An Advocated Numerical Model to Simulate the Constitutive Materials of Metal/Ceramic Bi-phased Beams

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Abstract: Currently, several approaches focused on the optimization of materials design and solutions to respond to the ecological and economic concerns through the development of novel materials and structures. In this connection, functionally graded materials (FGM) known as a new generation of composites with optimized mechanical properties which vary according to a continuous function-law to avoid interfacial debonding and stresses concentration were largely investigated. Accordingly, the main purpose of this work is to advocate a new way to simulate the mechanical behavior of simply supported FGM beams submitted to non-uniform static bending through a finite element modeling (FEM). The power-law function which governs the stiffness distribution of the used metal and ceramic materials are explicitly presented.

Keywords: Composite Structures; Functionally Graded Materials; Non-uniform bending; Numerical Modeling.

ICESSE2025-GC-MAT-024

4.48 Valorization of Pegmatite from Mekla Region in the Manufacturing of Fired Clay Bricks Based on Local Clay

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Abstract: This study explores the use of a local pegmatite and clay from the Mekla region (Algeria), historically used in traditional pottery, in clay-based brick production. The aim is to evaluate the effect of incorporating pegmatite from 0% to 30%, on the physical, mechanical, and thermal characteristics of the fired bricks. Both raw materials—clay and pegmatite—were characterized using chemical analysis, X-ray diffraction, thermal analyses, infrared spectroscopy, particle size analysis, and Atterberg limits (for clay). The bricks prepared from the formulated mixtures were fired at 900 °C. Flexural and compressive strength tests, loss on ignition, firing shrinkage, bulk density, open porosity, and thermal conductivity were performed. The results showed an increase in compressive strength and a significant reduction in thermal conductivity with increasing pegmatite content, making the bricks both stronger and better insulators. This work demonstrates the potential of these local resources for sustainable, high-performance brick manufacturing.

Keywords: Fired clay bricks; Pegmatite; Thermal properties; Mechanical strength.

ICESSE2025-GC-MAT-025

4.49 Thermal and physical evaluation of glass fiber textile waste based-members with hollow cores

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Abstract: In recent years, the use of fiberglass has significantly increased, becoming a fundamental component in composite materials due to its many advantages, such as durability, lightness, water resistance, insulation, and more. Numerous studies have been conducted on this material, especially concerning better recycling and recovery methods. From this perspective, the aim of this study is to develop an industrial process based on a demonstrative scale for recycling fiberglass waste and transforming it into cores for insulating panels. Fiberglass waste was recovered from the waste of a boat building factory, and several samples were created using polyester resins. The core samples made from GFRP waste underwent an evaluation of their physical properties, followed by an assessment of using a CT scale based on a panel placed between two identical samples according to the European standard. Generally, the results showed an improvement in thermal insulation performance in all samples compared to those reported in the literature for sandwich core members.

Keywords: GFRP waste; Recycling; Hollow cores; Physical features; Thermal conductivity.

ICESSE2025-GC-MAT-026

4.50 Mechanical Characterization of Arundo donax-Based Bio-composites Matrix for Sustainable Construction

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Abstract: This study investigates the compressive properties of Arundo donax (AD)-based bio-composites, aiming to evaluate their mechanical potential for sustainable construction materials. Cylindrical samples were prepared and tested for compressive strength following ISO standards. Results revealed maximum compressive strengths averaging 54.23 MPa, indicating potential alternative in construction materials

Keywords: Arundo donax, bio-based matrix, compressive properties, sustainable materials.

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4.51 Review of the effect of matrix composition on mechanical behavior of textile reinforced concrete

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Abstract: This work focuses on Textile Reinforced Cementitious Composites (TRC) and highlights the importance of optimizing the matrix composition to improve the mechanical performance of TRCs for structural and architectural applications. Incorporating short fibers, fly ash, and fine-grained sand, various formulations were analyzed to assess the influence of key parameters such as binder content, sand particle size, and water-to-binder ratio on compressive and flexural strength. The results show that the addition of PVA fibers and fly ash, combined with controlled sand granulometry, allows the production of composites that effectively balance strength and ductility.

Keywords: Textile reinforced concrete; Mix composition; Compressive strength; Flexural strength.

ICESSE2025-GC-MAT-029

4.52 Flexible piezoelectric sensors: towards intelligent, autonomous buildings

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Abstract: With a view to integrating flexible piezoelectric sensors into buildings, the project aims to establish an intelligent system for continuously monitoring the mechanical condition of buildings. These sensors, which generate energy from mechanical stresses (vibrations, pressures, cracks), guarantee early detection of structural anomalies and autonomous operation of the building, without depending on an external source of electricity. By integrating these sensors into walls, beams or foundations, it is possible to monitor certain critical indicators such as deformations, shocks or dynamic loads, enabling this collected information to be transmitted via an IoT network to a remote platform. This innovative approach not only guarantees building safety, but also facilitates predictive maintenance, and is part of a smart, sustainable housing approach that meets the growing needs of connected cities and the energy transition.

Keywords: Piezoelectric sensors; IoT; Smart housing; PVA/ZnO-Fe composite.

ICESSE2025-GC-MAT-031

4.53 Effet de la poudre de granite sur le comportement rhéologique des pates cimentaires

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Résumé : Les comportements rhéologiques sont des modèles mathématiques utilisés pour caractériser l'écoulement d'un matériau. Plusieurs modèles rhéologiques ont été proposés depuis le début de l'étude de la rhéologie. Le choix du modèle est justifié par le type de matériau étudié, la composition, la formulation ainsi que la vitesse de déformation à laquelle le matériau est soumis. Afin de mettre en évidence l'effet des paramètres de la formulation des pates cimentaires autoplacantes, une étude de l'influence de la poudre de granite sur le seuil de cisaillement et le comportement rhéologiques des pates cimentaires est proposée. Les résultats obtenus montrent que la poudre de granite influe directement sur le comportement rhéologique et la viscosité des pates cimentaires.

Keywords : Pates cimentaires ; Rhéologie ; Seuil de cisaillement ; Poudre de granite.

ICESSE2025 -GC-MAT-032

4.54 Performance evaluation of pervious concrete containing calcined mud under elevated temperatures

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Abstract: This study examines the behavior of pervious concrete incorporating calcined mud when exposed to high temperatures. The use of mud, an abundant sedimentary residue, as a partial substitute material in concrete composition aims to recycle waste while reducing the environmental impact of traditional concrete. However, the thermal performance of these concretes remains largely unexplored. Samples were prepared with different proportions of mud and then subjected to high temperatures simulating extreme conditions (fire). The mechanical properties were analyzed before and after heating. The results show that mud influences the thermal resistance, dimensional stability, and porosity of porous concrete. Although some formulations show a loss of performance at high temperatures, others retain acceptable functional porosity. These results open up prospects for the sustainable use of mud in infrastructures subject to thermal stresses.

Keywords: Pervious concrete; Performance; High temperature; Ultrasonic pulse velocity.

ICESSE2025-GC-MAT-033

4.55 Effect of Organic Material Incorporation on the Physical Characteristics of Plaster

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Abstract: This study assesses the impact of the progressive incorporation of an organic material into a gypsum-based matrix on the physico-thermal properties of the composite material obtained. Addition rates ranging from 0% to 10% by mass were analysed to determine their influence on the open porosity, water absorption and thermal conductivity of the material. We produced specimens measuring 40*40*160 mm³ for each formulation and subjected to experimental testing. The results show that the addition of water leads to a gradual change in the material's microstructure, resulting in an increase in open porosity. This structural evolution favours greater water adsorption, leading to a progressive increase in open porosity and, consequently, in water absorption capacity. Thermal conductivity measured in the dry state improves with the rate of addition, due to the increase in the porous fraction containing air, an excellent insulator. All these results confirm the interest of this bio-based composite for applications in the building industry. .

Keywords: Plaster; Open porosity; Adsorption; Thermal conductivity.

ICESSE2025-GC-MAT-034

4.56 Performances mécaniques d'un mortier de réparation des structures en béton

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Résumé : Cette étude présente l'élaboration et la caractérisation de mortiers modifiés aux polymères destinés aux travaux de réparation et de renforcement des structures en béton. Deux formulations ont été élaborées : M1 (ciment, fumée de silice et latex) et M2 (M1 + fibres de polypropylène), comparées à un mortier de réparation commercial (MC). Les essais à l'état frais incluaient l'ouvrabilité, la masse volumique et l'air occlus, tandis que les essais à l'état durci concernaient les résistances mécanique (compression et flexion), le retrait et l'adhérence. Les résultats ont montré que l'ajout de latex améliore considérablement l'ouvrabilité et l'adhérence. Les mortiers M1 et M2 présentent une résistance à la compression plus faible ($\approx 41-43$ MPa) que le MC (55 MPa), mais une résistance à la flexion comparable ($\approx 8, 3-8,6$ MPa). Le retrait est réduit pour M2 grâce aux fibres. Selon la norme EN 1504-3, les mortiers élaborés sont classés R3 correspondant à une résistance minimale de 25 MPa pour des réparations structurelles courantes, tandis que le MC est classé R4 correspondant à une résistance minimale de 45 MPa pour des réparations structurelles plus exigeantes. Ces résultats confirment le potentiel des mortiers à base de latex comme alternatives durables pour la réparation et le renforcement du béton.

Keywords : Mortier de réparation ; Latex ; Fibres de polypropylène ; Propriétés mécaniques ; Adhérence.

ICESSE2025-GC-MAT-035

4.57 Influence of Sand-Coated Rubber Shreds on the Mechanical Properties of Concrete Incorporating Recycled Conveyor Belt Waste

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Abstract: An enormous quantity of waste rubbers is disposed of on land surface, causing serious environmental pollution and degrading of the surrounding ecosystem. Various types of waste rubber are found globally, including Tire Rubber Waste, Natural Rubber Waste, Synthetic Rubber Waste, Rubber Sludge or Flash, post-Consumer Rubber Products, Rubber Dust or Fines. The present study utilizes industrial rubber waste obtained from a coal power plant, commonly known as conveyor belt rubber, as a sustainable alternative in concrete. To address the growing issue of rubber waste disposal, this material was incorporated into the concrete as a partial replacement for coarse aggregate. However, the inclusion of rubber often results in reduced mechanical strength due to the weak bond between the cement matrix and the smooth surface of the rubber particles. To improve this interfacial bonding, various surface treatment techniques have been explored. In the present study, the sand coating method was adopted to increase the surface roughness of rubber shreds and enhance their bonding with the cement matrix. The main objective was to evaluate the mechanical performance of rubberized concrete prepared with sand-coated rubber and without sand-coated rubber. Rubber shreds were incorporated at 2.5%, 5%, 7.5% and 10% by volume as a replacement for coarse aggregate. A separate mix design was developed for each proportion, and slump tests were conducted to assess the workability of the concrete. Concrete specimens in the form of cubes (100 × 100 × 100 mm), prisms (100 × 100 × 500 mm), and cylinders (150 × 300 mm) were cast for testing. Two specimen groups were prepared, one using rubber shreds without sand coating and the other using sand-coated rubber shreds. Strength tests were conducted on all specimens. The results demonstrated that concrete prepared with sand-coated rubber exhibited significant improvements in Compressive strength, Flexural strength, Modulus of Elasticity, Bond strength, Pull-out strength and impact resistance when compared to concrete without sand-coated rubber. Regression models were developed to predict these properties based on the combination of rubber volume fraction, coarse aggregate, fine aggregate, cement and water cement ratio. The models closely aligned with experimental data, confirming their effectiveness for forecasting concrete performance. These findings validate the effectiveness of surface treatment in enhancing the performance of rubberized concrete and support the reuse of industrial rubber waste as an eco-friendly construction material.

Keywords: Sand coated rubber shreds, Untreated rubber shreds, Pull-out strength, Bond strength and Impact Strength.

ICESSE2025-GC-MAT-036

4.58 Effect of Wood Sawdust Addition on Thermal Performance and Durability of Compressed and stabilized Earth Bricks

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Abstract: This study investigates wood sawdust incorporation in compressed stabilized earth blocks to address the building sector's significant environmental impact (40% of global energy consumption, 36% of greenhouse gas emissions). Four formulations were analyzed: BTSC1 (75% clay/25% sand), BTSC2 (50% clay/50% sand), both with 10% cement, and their variants with 1% wood sawdust (BTSC1W, BTSC2W). Results show BTSC2 achieved optimal structural performance (14.62 MPa compressive strength) while sawdust addition created a trade-off, reducing structural capacity but significantly enhancing thermal properties, with BTSC1W reaching exceptional specific heat capacity (2500 kJ/m³·K). The research establishes that BTSC2 suits load-bearing applications, BTSC1W excels for thermal mass uses, and BTSC2W offers balanced performance. This work validates earth-based materials as viable sustainable alternatives while supporting circular economy principles through waste valorization.

Keywords: Raw earth bricks; Wood sawdust; Thermal properties; Durability.

ICESSE2025-GC-MAT-038

4.59 Eco-Efficient High-Performance Mortar Based on Dune Sand: Punching Behavior Study

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Abstract: This study investigates the punching behavior of eco-efficient high-performance mortar (HPM) incorporating locally available dune sand as a sustainable fine aggregate alternative. The research aims to reduce environmental impact while maintaining or enhancing mechanical performance. An experimental program was conducted using several mortar mixes with varying dune sand replacement ratios and optimized binder compositions. Physical and mechanical properties, including compressive strength, flexural strength, and density, were first evaluated to identify the most promising mix. Subsequently, punching tests were performed on reinforced slabs made with the selected eco-efficient mortar to assess their ultimate load capacity, stiffness, and failure mechanisms. The results showed that partial replacement of conventional sand by dune sand, combined with a low clinker content and supplementary cementitious materials, can produce mortars with excellent mechanical behavior and reduced environmental footprint. Moreover, the punching resistance of slabs made with the optimized mix was comparable to that of conventional high-performance mortar slabs. This confirms the potential of dune sand as a viable raw material for sustainable and high-performance construction applications in arid regions.

Keywords: *Eco-efficient mortar; dune sand; experimental study; punching behavior; high-performance materials; sustainability; reinforced slabs.*

ICESSE2025-GC-MAT-039

4.60 Mechanical Behavior Modeling of a Cementitious Mortar Reinforced with Cellulose Fibers

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Abstract: This study focuses on modeling the mechanical behavior of a cement mortar reinforced with cellulose fibers, with a view toward sustainable construction. Cellulose fibers, derived from renewable resources, offer ecological benefits while improving the ductility and crack resistance of the material. Experimental tests were conducted to evaluate the flexural strength and fracture behavior of the modified mortar. The results show that the fiber-matrix interaction delays crack propagation. The study also investigates the effect of fiber content and distribution on the overall performance. A comparison with conventional mortar reveals improved post-cracking behavior. This research opens up new perspectives for the development of more durable and sustainable construction materials.

Keywords: *Cellulose fiber-reinforced mortar, Mechanical behavior, Flexural strength, Crack resistance.*

ICESSE2025-GC-GEOT-001

4.61 Effect of Soil Behavior Model on Retaining Wall Deflection

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Abstract: The finite element method is a useful tool, widely used in recent years to analyze the deep excavations behavior, but the accuracy of the finite element analysis depends on the selection of appropriate constitutive models and material parameters. This paper presents the numerical analysis of a deep open excavation for a metro station in Algiers city using Plaxis software. Three models are used in this study, the Mohr Coulomb model, the hardening soil model and the hardening soil model with small-strain stiffness, to emphasize the impact of constitutive model on the ground movements. The HSS model seems to give more reasonable results of ground movements than the other models.

Keywords: *Deep excavation; Mohr Coulomb model; Hardening model; HSS model.*

ICESSE2025-GC-GEOT-003

4.62 Modeling the Tizi-ouzou Landside

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Abstract:

Natural disasters called landslides have the potential to seriously harm people's safety, the environment, and structures in addition to causing considerable damage to infrastructure. It is therefore important to be able to model and predict these phenomena. This paper focuses on modeling using a finite element model behavior and assesses the stability of a slope by calculating the safety coefficient. The characterization work was carried out on a landslide at the site located in Tizi-Ouzou (Algeria). Verification of the stability of this area, while taking into account the morphology and local geological context of the site, was carried out by finite element modeling using the Mohr-Coulomb criterion, making it possible to extract the stress field, displacements and deformations and also to find the sliding surface corresponding to a minimum FOS safety coefficient.

Keywords: *Finite Elements; Landslide; Castem; Safety Coefficient.*

ICESSE2025-GC-GEOT-004

4.63 Vibration response of a horizontal soil granular layer under harmonic excitation : A Discrete Element Modeling approach

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Abstract: This paper is aimed at analyzing the vertical wave propagation in a sand deposit through micromechanical modeling that inherently takes account of intergranular slips during deformation. For this purpose, a 2D Discrete Element Method (DEM) model is developed. Using this model, the fundamental and resonance frequencies of the deposit are first determined. The former is determined from the low-amplitude free vibration and the latter by performing a variable-frequency excitation test. It is noted that there is a significant gap between the two frequencies; this gap could be attributed to the degradation of the soil shear modulus in the vicinity of the resonance. Such degradation is well proven in classical soil dynamics. The effects of deposit confinement on the surface dynamic amplification factor are then investigated. The obtained results highlighted that when the confinement increases, the deposit becomes stiffer, which results in reducing the amplification.

Keywords: *Micromechanical model; Sand deposit; Discrete element method; Shear wave propagation;*

ICESSE2025-GC-GEOT-005

4.64 Plastic Waste in Asphalt: A Sustainable Solution for Moisture-Resistant Pavements

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Abstract: Facing environmental challenges related to waste management and natural resource limitations, the recycling of bituminous mixtures from flexible pavements constitutes a sustainable alternative for pavement rehabilitation. This study is part of a plastic waste valorization approach, particularly from used brushes and brooms, by integrating them as modifying additives in hot recycled asphalt concrete. The base material is reclaimed asphalt pavement (RAP) recovered from an old road surface, whose binder content was determined by extraction according to the KUMAGAWA method. The extracted bitumen allows characterizing the reuse potential of the RAP. The recycled mixture is then modified by adding plastic waste at rates of 2%, 4%, and 6%. Its performance is evaluated through compressive strength measurements before and after immersion, with the aim of analyzing its moisture sensitivity. The results show a progressive improvement in mechanical strength and better water resistance of the modified mixture, particularly at higher rates. The study thus confirms the technical and environmental feasibility of this solution, which contributes to plastic waste reduction and extension of road infrastructure service life.

Keywords: Hot recycling; Plastic waste; Moisture resistance; Environmental sustainability; Asphalt concrete;

ICESSE2025-GC-GEOT-009

4.65 Effect of granulometry on the compressibility of granular soils (case of dry sands)

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Abstract: The sand grain size distribution is an important factor that defines its behavior under a loading path. Experience has shown that grain size distribution and its evolution during loading affect the interactions between grains, which in turn influence the behavior of these materials at the macroscopic scale and the evolution of deformations as a function of stresses. In this work, we present the results of an experimental study on the effect of initial grain size and its evolution on the behavior of sands during compression loading. The materials used for the tests were sand collected from coastal beaches in the eastern region of Béjaïa. The results obtained led to the conclusion that the initial structure of the sand sample plays a very important role in the evolution of its grain size and behavior, and that grain breakage is the cause of this evolution.

Keywords: Sand; Grain size; Compression; Behavior.

ICESSE2025-GC-GEOT-010

4.66 Influence de la largeur de la bande renforcement et de l'angle du talus sur le renforcement superficiel d'une pente en sable

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Résumé : L'étude se focalise sur l'influence de la largeur de la bande renforcée et de l'angle du talus sur la stabilité d'une pente en sable renforcé par des fibres de sisal. Un sable avec une cohésion de 2,1 kPa et un angle de friction de 38,3°, renforcé avec 0,25% de fibres de sisal est considéré. En utilisant le logiciel Plaxis 2D et le modèle de calcul de Bishop, les résultats obtenus montrent qu'un renforcement plus large améliore significativement le facteur de sécurité (FOS). Le FOS augmente plus rapidement avec les premières largeurs de renforcement sans autant atteindre le FOS minimale recommandé de 1,5, puis il diminue d'une manière remarquable. Pour un angle de talus de 80°, une largeur de 2,8 m atteint un FOS de 1,5, tandis qu'une pente de 40° nécessite 2 m. Pour des pentes plus raides, il est nécessaire d'augmenter le renforcement pour atteindre la stabilité. L'angle du talus influe sur l'efficacité du renforcement.

Keywords : Largeur de renforcement ; Angle de talus ; Stabilité des pentes ; Facteur de sécurité.

ICESSE2025-GC-GEOT-011

4.67 Geotechnical isolation system to mitigate earthquake using rubber sand mixture

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Abstract: Rubber is increasingly used in many civil engineering applications. Due to its high damping capacity, shredded or cut recycled rubber is mixed with sand to obtain a rubber-sand mixture (RSM), a composite material with a significantly higher energy absorption capacity than soil alone. It is believed to reduce the energy applied to structures, as well as the stresses and shocks they undergo. In this work, the RSM mixture is inserted as an insulating layer under the foundation of a structure to mitigate earthquakes. RSM is used as a geotechnical isolation system for vibration absorption. The foundations of a four-story building are embedded in a soil profile into which a layer of RSM has been inserted to act as a seismic insulator during seismic excitation applied to the bedrock. The numerical study focuses on the variation of the layer thickness and the results confirm that the incorporation of a 1m to 4m thick RSM layer in the soil profile can reduce the effect of earthquakes, considerable acceleration gains at the top of the building as well as at the foundation level.

Keywords: Building; Seismic isolation; Rubber sand mixture; Geotechnical

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4.68 The effect of a model parameter on deformation

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Abstract: The safety of the stoppings is a significant subject. It is rather a requirement, present in way more or less explicit in any act and any decision of each speaker in the design, the construction and the exploitation of a stopping. Safety depends on many small details execution and exploitation, as much as fundamental choices of project. Using software PLAXIS in finite elements, this work, after a library search, is interested in the sensitivity of the deformations of the earth dams to the models of behavior of the ground. A study of sensitivity of the deformations to the parameters of the model will be made for the model of Mohr-Coulomb and an application was made on the dam Koudiet Lamdaouar to Timgade wilaya of Batna.

Keywords: Earth dam; Numerical modeling; PLAXIS; Deformations.

ICESSE2025-GC-GEOT-013

4.69 Influence of Column Length and Geosynthetic Reinforcement on the Bearing Behavior of Foundations on Compressible Soils

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Abstract: Building on compressible soils often results in structural instability, excessive settlement, and deformation over time. To mitigate these effects, reinforcing foundations with stone columns has proven to be an efficient and economical method. These columns help minimize settlement and increase structural resilience. Using Plaxis 2D v20, simulations were carried out to assess how the ratio of column height (H_c/H) and the extent of geosynthetic confinement (H_g/H_c) impact vertical settlement, as well as the effect of the extent of geosynthetic confinement (H_g/H_c) on vertical settlement for anchored columns. The study revealed that combining stone columns with geosynthetic materials greatly enhances foundation performance. Both column height and the level of confinement were found to be critical in improving soil behavior and reducing settlement. The simulations also indicated that a rise in groundwater level worsens settlement. These insights offer valuable guidance for optimizing foundation reinforcement in soft soil conditions.

Keywords: Compressible soils; Stone columns; Geosynthetics; Foundation performance.

ICESSE2025-GC-GEOT-014

4.70 Effet des caractéristiques d'élasticité sur la déformabilité d'un massif de sol lors de l'excavation d'un ouvrage souterrain.

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Abstract : L'excavation d'ouvrages souterrains en général, et de galeries en particulier, provoque des déformations dans le massif de sol. Ces déformations pouvant induire des instabilités au niveau de l'ouvrage et en surface. L'estimation des mouvements de terrain et la prédiction des solutions sont très complexes, car elles dépendent de plusieurs facteurs géologiques, géotechniques et hydrogéologiques du massif, ainsi que des dimensions de l'excavation. La réponse finale d'un massif de sol dépend de sa capacité à se déformer sans s'effondrer. Cette réponse dépend généralement de ses performances, qui sont liées à son comportement rhéologique et à sa plasticité. Dans ce travail, nous présenterons les résultats d'une étude de l'effet des paramètres d'élasticité d'un sol sur sa déformabilité lors du creusement d'une excavation peu profonde. Pour modéliser le problème, une simulation du creusement d'une excavation à l'aide d'un programme de calcul utilisant la méthode des éléments finis est réalisée.

Keywords : Sol ; Excavation ; Elasticité ; Déformation.

ICESSE2025-GC-GEOT-015

4.71 Study of the behavior of the ground crossed by the Draa El Mizan tunnel (Tizi-Ouzou).

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Abstract: The characterization of the soil crossed by underground excavations is a multidisciplinary problematic, encompassing geological, geotechnical, design, and implementation aspects. It aims to understand the behavior of the tunnel and its environment to ensure the stability and safety of the structure. Given its fragile and instability-prone ground, the Draa El Mizan tunnel represents one of the major challenges encountered during the construction of the penetrating road, linking the province of Tizi-Ouzou to the East-West Highway at Bouira. This work involves studying the behavior of these grounds during excavation, comparing numerical methods with empirical and analytical methods, which highlights, despite the complementary nature of these techniques, the need to use numerical tools to address the simplifying assumptions of the older formulas.

Keywords: Tunnel ; Behavior; Numerical method; Convergence.

ICESSE2025-GC-GEOT-016

4.72 Parameters affecting the overturning resistance of geotechnical structures

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Abstract: Geotechnical structures are susceptible to several modes of failure, including sliding and overturning. While sliding is frequently considered the dominant cause of instability, overturning can also critically affect structural performance, particularly when the inherent spatial variability of soil properties is neglected. This study adopts a probabilistic approach contrasting with traditional deterministic methods to evaluate the impact of soil variability on the overturning stability of geotechnical structures. Using Monte Carlo simulations implemented in MATLAB, the influence of the coefficients of variation of key soil parameters on the probability of overturning failure is assessed across a range of safety factors. Results indicate that the variability of the backfill's internal friction angle plays a decisive role in overturning stability, rendering a safety factor of 1.5 insufficient to meet the target failure probability of 10^{-4} . In comparison, the variability of the backfill's unit weight has a negligible effect.

Keywords: Overturning; Spatial variability; Failure probabilities; Probabilistic methods.

ICESSE2025-GC-GEOT-018

4.73 Improving the Mechanical Properties of a Clay Soil by Adding Waste Rubber: Direct Box Shear Tests

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Abstract: The process of adding rubber waste is a promising technique for reinforcing fine, loose soils with low mechanical strength. The technique has proved highly effective in laboratory tests on several types of soil. In the present article, a protocol for direct box shear tests on a clay soil was developed in the laboratory to pre-prepare Fontainebleau clay samples with different percentages of addition. Drained shear tests at different confining stresses were carried out on these samples. These tests were followed by microscopic and X-ray observations to understand the microstructural impact of calcite precipitation. Overall, the results show good repeatability of biocementing by the protocol followed, as well as low heterogeneity in the profile of the biocemented specimens. These results also showed a significant increase in the mechanical strength of the biocemented sand specimens. More-over, from a microstructural point of view, calcite precipitation is almost localized at grain contacts, resulting in very good mechanical efficiency (strong increase in cohesion), with little decrease in permeability, especially for low levels of calcification.

Keywords: Rubber wastes; Direct shearing; Improvement; clay soil; Mechanical properties.

ICESSE2025-GC-GEOT-019

4.74 Experimental, numerical and statistical study of the degradation of marls under cyclical effects.

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Abstract: The lifespan of civil engineering works depends essentially on the behavior of the materials used as base layer or construction materials with respect to external stresses generated by the work itself or by natural phenomena such as earthquakes and climate. For this, several factors must be taken into account, namely climatic conditions and their cyclical changes. The aim of our research is to show the influence of the latter on soil degradation by carrying out the degradability test on marl. The results of our study lead to calculate the fractal dimension in 2D by the Box Counting method with MATLAB, which allowed to evaluate the variation of the shape and texture of the samples studied, which was found to have a strong influence on the calculated fractal dimension (DF_R) and which is also proven by a statistical study made with the R software.

Keywords: Withdrawal-swelling; Fine soil; Fractal dimension; Statistical analysis.

ICESSE2025-GC-GEOT-020

4.75 Facteurs influant sur la stabilité des pentes et estimation de leur effet.

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Résumé : Les méthodes de calcul de stabilité des talus sont nombreuses. Actuellement, il n'existe pas de réglementation des justifications de la stabilité des talus. Suivant le problème traité, on fera un calcul à la rupture ou un calcul en déplacement. Les raisons qui expliquent cet état de fait sont nombreuses dont la difficulté de la caractérisation des facteurs influant sur leur stabilité et l'estimation de leur effet. La nature complexe du sol, l'existence de l'eau et son influence, le chargement, la géométrie, sont des exemples de facteurs déterminants dans la difficulté d'une estimation exacte du comportement des talus. De nombreux auteurs s'intéressent à ce sujet et il n'est pas encore de situation claire et définitive, ni du point de vue de la méthode de calcul ni d'un bilan exhaustif des facteurs influents. Notre objectif est de dresser un état de l'art de l'ensemble des facteurs dont l'influence sur la stabilité des pentes et des talus est certaine et prépondérante.

Keywords: Glissement de terrains ; Etude probabiliste ; Eléments finis ; Variabilités spatiales.

ICESSE2025-GC-GEOT-021

4.76 Analysis of the liquefaction potential of an Algerian soil

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Abstract: The phenomenon of soil liquefaction is one of the effects of earthquakes with the landslides and the tidal waves. The passage of a seismic wave causes, in many geological formations, the loss of resistance of a saturated sandy material due to an increase in the pore water pressure generated by the cyclic deformations. The brutal deconsolidation of material results by the modification of the structure of the ground, returning particularly unstable the structures existing on these formations. The proposed deals the analysis of liquefaction potential of a site located in Béjaia, a town classified as Zone IIa (RPA 2003). This analysis is performed analytically using the empirical simplified method of Seed, Idriss et al (1982-1985) and numerically by using the code FLAC2D taking into account the registrations recorded during the earthquake of May 21 2003.

Keywords: Earthquake; Liquefaction; Effective stress; Pore pressure.

ICESSE2025-GC-GEOT-022

4.77 Study of the Compaction Behavior of Shale-Slag Mixtures for Road Construction

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Abstract: The construction and public works sectors have seen rapid global growth, leading to an unprecedented demand for aggregates. However, traditional sources such as quarries and alluvial deposits are becoming depleted and insufficient. To address this shortage, researchers are investigating alternative natural materials and industrial by-products. This study explores the use of mixtures of shale and crystallized slag in pavement structures without significant modification or treatment. Proctor compaction tests were conducted in the laboratory on reconstituted samples to assess their densification behavior and compaction suitability. The results, particularly for mixtures containing 15% of slag, are promising and comply with current technical standards. This research offers a sustainable alternative for low to medium traffic roads, helping to preserve natural resources and reduce environmental impact.

Keywords: Blast furnace slag; Shale; Compaction; Road construction.

ICESSE2025-GC-GEOT-023

4.78 Simulation of The Behavior of the Sidi Khelifa Dam During Construction and Filling

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Abstract: Seepage is a major cause of dam failure, inducing internal erosion and potentially catastrophic failure. The aim of this work is to examine the impact of seepage on the stability of the Sidi Khelifa earth dam, located in Azeffoun, in the wilaya of Tizi-Ouzou (Algeria), using the PLAXIS 2D finite element code. The dam is modeled in two parts. The first part contains the various construction phases of the dam. The second part represents the filling of the dam in four steps. Deformations and stresses, as well as pore pressures are analyzed. The dam's stability is evaluated at the end of construction and during the reservoir level increases.

Keywords: Stability; Earth dam; Filling; PLAXIS 2D.

ICESSE2025-GC-GEOT-024

4.79 Assessment of the Vulnerability of Bituminous Pavements in Northern Algeria Under Dynamic and Seismic Loads

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Abstract: Flexible bituminous pavements represent the primary road infrastructure in northern Algeria, playing a crucial role in regional socio-economic development and mobility. However, these structures are vulnerable to deformation caused by extreme climatic conditions (intense heat and cold), frequent overloading by heavy trucks, and earthquakes, which are common in this moderate to high seismicity zone. This study aims to assess the vulnerability of these pavements by determining a specific index using the Analytic Hierarchy Process (AHP) method. A mathematical analysis of an evaluation matrix integrating both intrinsic and anthropogenic parameters influencing the dynamic and seismic response of flexible bituminous pavements was carried out to define the relative weights of each parameter affecting overall vulnerability. This structured and quantitative approach provides a robust framework for establishing a vulnerability index adapted to the dynamic, seismic, and functional context of flexible pavements in northern Algeria.

Keywords: *Flexible pavements; Dynamic and seismic vulnerability; AHP method; Vulnerability index; Northern Algeria roads.*

ICESSE2025-GC-GEOT-025

4.80 Comportement À L'humidification Sous Contraintes D'une Argile Gonflante Compactée À Faible Teneur En Eau. Application Aux Sols D'infrastructures De Transports.

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Abstract : Utiliser les sols de site est intéressant dans une perspective de développement durable : réduction des coûts, valorisation locale des matériaux. Toutefois, ces sols présentent des risques de déformations (instabilité volumétrique) liés aux variations de leurs états hydriques. Dans ce contexte, cet article propose un protocole expérimental permettant d'identifier les phénomènes de gonflement et d'effondrement dans une argile gonflante, compactée à faible teneur en eau (ce qui est typique des sols de site utilisés comme remblais d'infrastructures de transports), soumise à une humidification sous contraintes œdométriques. Des essais ont été menés sur des échantillons de cette argile, provenant de la région de Tizi ousou (Algérie), compactés statiquement à différentes masses volumiques sèches initiales. Les résultats obtenus mettent en évidence l'importance du chemin de chargement (chargement mécanique puis humidification après équilibre) sur l'évolution des déformations induites. L'analyse de ces résultats souligne le besoin de prendre en compte à long terme le comportement des ouvrages contenant ce type de sol.

Keywords : *Argile gonflante; Compactage à faible teneur eau ; Effondrement ; Gonflement.*

ICESSE2025-GC-GEOT-026

4.81 Caractérisation Géotechnique d'un sol par l'Etude de ses Niveaux de Succions

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Abstract : Ce travail porte sur la caractérisation d'un sol par l'étude de son comportement hydrique. Il s'agit d'une étude expérimentale sur des échantillons provenant d'un site ayant présenté des signes d'instabilité relevés notamment sur des tronçons de route et une partie d'un terrain. Le comportement hydrique est étudié à travers l'analyse de la variation de succion dans le sol. Cette dernière qui représente la pression interstitielle négative dans le sol est utilisée pour l'étude des sols non saturés. Elle peut être déterminée par des méthodes de mesure directe telle que la méthode de papier filtre ou par des méthodes indirectes telle que la méthode des solutions salines. L'imposition de succions en chemin séchage-humidification a abouti à des résultats présentés à travers des courbes reliant les paramètres physiques du sol aux succions, notamment la courbe de rétention d'eau du sol, nous renseigne sur le comportement singulier du sol, donnant une perspective sur l'origine des désordres constatés.

Keywords : *Succion ; Non-saturé ; Méthode ; rétention.*

ICESSE2025-GC-GEOT-027

4.82 Influence of tack coat on performance and durability of road structures

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Abstract: Pavements are multi-layer composite structures subjected to combined mechanical and climatic stresses, and their durability depends largely on the quality of bonding between layers. This study explores the role of the tack coat in improving the performance and longevity of roadways, with a focus on the 80/100 bitumen-based cationic slow-breaking emulsion ECR 65. Two pavement designs were evaluated: one incorporating ECR 65 and one without. The findings show that ECR 65 significantly improves interlayer adhesion, leading to monolithic behavior that promotes uniform stress distribution, reduces differential deformation, lowers the risk of delamination, and extends service life. Conversely, inadequate bonding results in early surface damage, including cracking and potholes. The study emphasizes the importance of adhering to application standards, particularly a minimum residual bitumen content of 300 g/m². Overall, ECR 65 proves to be a practical, economical, and sustainable solution for enhancing the structural integrity and durability of bituminous pavements.

Keywords: *Pavements; damage; tack coat; ECR65.*

5. Mechanical Engineering

ICESSE2025-ME-001

5.1 Influence of a 3% NaCl Saline Medium on the Mechanical and Structural Properties of PDMS

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Abstract: The study focuses on the influence of a saline environment (3% NaCl solution) on the mechanical behavior and chemical stability of an industrial RTV-1 type silicone, commonly used in plumbing sealant applications. The experiment was conducted over a period of 20 days, using techniques such as creep testing, microscopic observation, FTIR spectroscopy, and tensile testing. Immersion of the PDMS in the 3% NaCl solution led to an increase in time-dependent deformation, along with a significant reduction in both tensile strength and elongation compared to the air-exposed sample. Microscopic analysis revealed increased surface degradation in the saline environment, characterized by the appearance of microporosity and signs of oxidation. FTIR analysis confirmed the overall molecular stability of the PDMS, despite surface-level interactions with the aggressive medium.

Keywords: RTV-1 silicon; Saline ageing; FTIR analysis; Mechanical behavior.

ICESSE2025-ME-002

5.2 Influence du champ magnétique sur la résistance à la corrosion de l'acier inoxydable 316L dans les solutions de chlorure de sodium contenant du glucose.

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Abstract : Nous avons étudié le comportement à la corrosion de l'acier inoxydable AISI 316L destiné à une utilisation comme matériau d'implant, dans des solutions de NaCl à 0,9 % en masse, contenant différentes concentrations de glucose, à 37 °C et en présence d'un champ magnétique perpendiculaire, hétérogène et de faible intensité. Les analyses ont porté sur le potentiel en circuit ouvert (OCP), les courbes de polarisation ($\log i = f(E)$) ainsi que sur des observations microscopiques optiques. Les résultats ont montré que l'augmentation de la concentration en glucose améliore le potentiel de corrosion libre et la résistance de polarisation, tout en réduisant la vitesse de corrosion de l'acier inoxydable étudié. De plus, la combinaison du champ magnétique et de l'ajout de glucose dans la solution de NaCl exerce un effet synergique, renforçant notablement la résistance à la corrosion de l'AISI 316 SSL.

Keywords: Implants; Corrosion; Glucose 3; Polarisation 4.

ICESSE2025-ME-004

5.3 Study of the effects of rolling strain hardening on the aging of 7075 Aluminium alloy.

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Abstract: This study investigated the effect of cold rolling strain on the artificial ageing of 7075 Aluminium alloy. After solution treatment, the alloy was cold-rolled with thickness reductions ranging from 12% to 55% and then aged at 120 °C and 150 °C. The high dislocation density from cold working accelerated the precipitation kinetics. The highest hardness was achieved at a 55% reduction and 150 °C ageing, indicating that η' precipitates provided the optimal strengthening. However, ageing at 150 °C increased the risk of over-ageing. A 32% reduction followed by ageing at 120 °C offered the best compromise between strength and durability. This optimized process significantly improves mechanical properties while also reducing ageing time, making it highly beneficial for industrial applications.

Keywords: Aluminum alloy 7075; Cold rolling; Artificial ageing; Precipitation; Hardness.

ICESSE2025-ME-006

5.4 Analyse Comparative entre Revêtements Multicouche et Monocouche : Essai de Dureté

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Résumé : Des monocouches de TiN et de CrN ainsi que des multicouches de TiN/CrN ont été déposées par voie PVD (physical Vapor Deposition) sur des substrats en aciers. La texture, la morphologie ainsi que la quantification des éléments chimiques constituant les phases en présence des revêtements obtenus ont été révélées par un microscope à balayage électronique (MEB) associé à un EDS-WDS. Les duretés des revêtements étudiés ont été obtenues par des tests de nanoindentation en utilisant le model d'OLIVER et PHARR. La substitution des revêtements monocouches de TiN et de CrN par les multicouches TiN/CrN a engendré une amélioration de la dureté de 2 fois, ceci affecte positivement la résistance des revêtements à l'usure. Cette étude a été menée pour comprendre les effets de la stratification des dépôts de couches minces sur les caractéristiques physiques des revêtements, afin de les appliquer aux systèmes tribologiques.

Keywords : Monocouches TiN et CrN; Multicouche TiN/CrN; Dureté; Résistance à l'usure.

ICESSE2025-ME-007

5.5 Study of the Behavior of a Polyester/Chicken Feather Fiber Composite Under Thermal Stress

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Abstract: Valorization of Chicken Feather Waste as a Reinforcing Filler in Unsaturated Polyester Matrix. This study aims to valorize animal waste, specifically chicken feathers (FP), by incorporating them as reinforcing fillers in an unsaturated polyester (UP) matrix. To enhance interfacial adhesion, two chemical treatments were applied: alkaline and acetylation treatments.

Fourier-transform infrared spectroscopy (FTIR) analysis of treated and untreated FP revealed that acetylation occurred successfully, as evidenced by the reduction of the hydroxyl (OH) absorption band at 3850 cm⁻¹, corresponding to ester groups. The mechanical behavior of the composites was also investigated. The thermal aging behavior of the chicken feather/polyester composites was also examined. Visual observations revealed a color change on the surface of both treated and untreated composites after aging. Attenuated total reflectance infrared spectroscopy (ATR-IR) confirmed chemical degradation (thermo-oxidation), leading to a decrease in the Young's modulus. A reduction in the flexural modulus was also observed.

Keywords: Chicken feather; Unsaturated Polyester; Mechanical proprieties; Thermal again.

ICESSE2025-ME-009

5.6 Investigating Rheological Properties and Stability of Oil/Water Emulsions Under the Effect of Temperature and Oil Concentration

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Abstract: This applied research focuses on studying the influence of mineral oil concentration (Maxisol 1 type) and temperature on the stability and rheological behavior of water-based cutting oil emulsions. To evaluate the stability of the emulsions, two methods were used: a visual inspection and optical microscopy analysis. For the rheological study, we focused on how concentration and temperature affect intrinsic rheological parameters. Rheological parameters were measured using a RheoStress 1 rheometer. Two experimental approaches were conducted: one varying the concentration, and the other varying the temperature (from 25 to 100°C). The emulsions were prepared with different concentration of cutting oil (3,4,6,7,8,10,15 and 20%) in distilled water. The results show that the rheological behavior of the emulsions is more consistent with the Herschel-Bulkley rheological model than Newtonian behavior. This observation holds true regardless of concentration or temperature, and aligns well with findings in the literature. The study reveals that both concentration and temperature significantly influence the intrinsic rheological parameters of the emulsions, such as yield shear stress, viscosity and flow index. Experimental results also indicate that dynamic viscosity is more strongly affected by temperature.

Keywords: Rheological Properties; Concentration cutting oil; Oil/water emulsions; Cutting oil.

ICESSE2025-ME-010

5.7 The Bacci and Bennati Problem with a Circular Crack in a Thin Elastic Medium

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Abstract: The aim of this work was to investigate an axisymmetric problem involving a circular crack embedded in a thin plate subjected to torsion. The torsion is induced by a circular rigid disk attached to the upper surface and constrained by an undeformable support at the lower surface. The problem was solved by applying the Hankel transform, reducing it to a system of dual integral equations, which were further simplified into Fredholm integral equations of the second kind. These equations were then solved numerically using the Gaussian quadrature rule. Dimensionless plots were presented to illustrate the influence of the geometric length scale and the ratio between the disk and crack radii on the crack's stress intensity factor.

Keywords: Circular crack; Axisymmetric torsion; Stress intensity factors; Fredholm integral equations.

ICESSE2025-ME-011

5.8 Multi-Objective Optimization of a Plastic Planetary Gear Pair Using the Marine Predators Algorithm

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Abstract: This study presents a multi-objective optimization of a plastic gear pair for planetary transmissions, simultaneously targeting wear resistance, thermal stability, and deformation minimization. The optimization employs the Marine Predators Algorithm (MPA), a recent and powerful metaheuristic, with performance rigorously benchmarked against a conventional baseline design. The engineering models used for wear, contact and bending stress, temperature rise, and deformation are simplified but based on established, widely accepted formulations. The results demonstrate substantial enhancements in gear performance—most notably, significant reductions in peak operating temperature and tooth deformation, albeit with a trade-off in wear resistance—while ensuring all safety and durability constraints are satisfied. These findings validate the practical advantages of advanced metaheuristic approaches, such as MPA, in the robust design of plastic gear systems.

Keywords: Planetary gear; Metaheuristic optimization; Wear resistance; Marine Predators Algorithm.

ICESSE2025-ME-012

5.9 Gas Sensor Based on Cerium Oxide and Its 3% Carbon Fiber Composite

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Abstract: In this study, we report the development of gas sensors based on pure cerium oxide (CeO_2) and a CeO_2 composite incorporating 3 wt.% carbon fibers (CeO_2/CF). CeO_2 was synthesized via the sol-gel method, while the composite was prepared through a hydrothermal process. Structural and textural characterizations confirmed the increased surface area of the composite. Gas sensing performance was evaluated toward ethanol, acetone, and benzene. Both sensors exhibited good sensitivity, with enhanced selectivity toward acetone. Notably, the CeO_2/CF sensor showed a higher response compared to pure CeO_2 , which is attributed to improved electrical conductivity and greater active surface area due to the presence of carbon fibers. These results demonstrate that the incorporation of a small amount of carbon fibers into CeO_2 is an effective strategy to enhance the sensitivity and selectivity of metal oxide-based gas sensors, particularly for detecting acetone.

Keywords: carbon fibers; CeO_2 Oxide; Gas sensor; sol-gel synthesis.

ICESSE2025-ME-014

5.10 The strain energy density factor in Mode-I: The role of surface effects on crack propagation

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Abstract: The Strain-Energy-Density (SED) factor originates from the pioneering work of Sih[1974], that is, a fracture-criterion for predicting crack initiation at macro-scale. In this shortcommunication, we propose to compute numerically SED-Factor at micro or nano scales by using the He-method. Doing so, the surface elasticity theory arises from the Ru-model was implemented in the FE-COMSOL commercial code. To run the computational modelling, we use the mechanical properties of the Aluminium. To account surface effects; we are concerned with a blunt crack that has a curvature radius, say and dimensionless parameter s that highlights scale effect. We focus on the mode-I loading and some FE-simulations are performed in order to compute the SED-factor. The FE-results are consistent and validated in comparison with results of literature.

Keywords: Strain energy density; Surface effects; Blunt crack; FE-Simulations.

ICESSE2025-ME-015

5.11 Finite element analysis of an intelligent mechanism using a piezoelectric material

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Abstract: In order to overcome the limited displacement of piezoelectric stack actuators, this paper proposes a novel compliant amplification mechanism for achieving a large stroke and solve the problem of small displacements in this materials, so that its areas of use can be broadened. This study describes the technical contribution by discussing the new rectangular parallelepiped design based on a two-stage lever with combination of rectangular and circular flexure hinges which provide a wide range of movement with minimal deflection. Our evaluation confirms significant advancements in resolution, amplification, and compact structure. Finite element analysis (FEA) validated our analytical results. The FEA simulation demonstrated our mechanism's remarkable amplification capability, achieving a final displacement of 0.7167 μm from a 0.04269 μm input from the PZT. This translates to a significant amplification ratio of 16.79. Moreover, the FEA results confirmed that the stress remains well below the yield strength of the material. This prioritizes user safety and ensures reliable, long-term performance across diverse applications. The work presented in this paper is a powerful tool that fills a gap in modern research. It is widely used in fields that require high precision, such as medical devices, micro-positioning and robotics.

Keywords: Piezoelectric actuator; Compliant mechanisms; Displacement amplification mechanism; Finite element analysis; Free vibration.

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5.12 Free vibration Behavior of Functionally Graded Nanocomposite Plates Reinforced with Linear and Nonlinear Distributed Carbon Nanotube Nanofillers in Thermal Environment

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Abstract: The present study investigates the influence of temperature and nanofillers distribution patterns (both linear and nonlinear) on the free vibrational behavior of nanocomposite plates using a layer-wise formulation approach. The plate consists of a polymethyl methacrylate (PMMA) matrix reinforced with carbon nanotubes (CNTs), which are either uniformly distributed or functionally graded (FG) through the plate thickness. The analysis is based on the First-Order Shear Deformation Theory (FSDT). The material properties of both matrix and reinforcement are assumed to be temperature-dependent, while the effective properties of the nanocomposite are determined using the extended rule of mixtures. To ensure the reliability of the model, a validation study is performed by comparing the results with reference data from the literature. A comprehensive parametric analysis is then conducted to examine the effects of temperature variation, CNT weight fraction, and distribution pattern on the free vibration characteristics of functionally graded CNT-reinforced composite (FG-CNTRC) plates.

Keywords: Free vibration; Temperature environment; Nanocomposite; Carbon nanotube; Functionally graded; First-order shear deformation theory.

ICESSE2025-ME-017

5.13 Optimization of the Geometric Parameters of a Composite Laminate Using Genetic Algorithm

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Abstract: Unlike the typical traditional hill-climbing techniques to design a composite laminate. A genetic algorithm code in MATLAB is proposed in this work to optimize of the geometric parameters of laminates panels, treating the following design variables: number of layer, fiber orientation angle and thickness of each layer. The optimization is based on Tsai-Wu criteria and the genetic operators are applied randomly. In order to get the best panels suiting and satisfying the engineer needs.

Keywords: design, Genetic Algorithm, composite laminate, optimization, Tsai-Wu.

ICESSE2025-ME-018

5.14 Controlled optimization of heat treatments for 304L TRIP steel: Correlating processing parameters with microstructure and mechanical properties

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Abstract: This study investigates the influence of heat treatment parameter temperature, holding time, and cooling method on the mechanical behavior and microstructure of 304L TRIP stainless steel, used in demanding structural applications. Specimens were heat-treated at temperatures from 950°C to 1200°C, held for 30 to 120 minutes, and cooled in air, oil, or water. Mechanical testing and metallographic analysis revealed that higher temperatures promote recrystallization and grain growth, improving ductility. Longer holding times enhance toughness through structural homogenization. Water quenching yields the finest microstructure and highest post-deformation hardness, indicating a more active martensitic transformation. The optimal condition 1100°C for 60 minutes followed by water quenching provides a favorable balance of strength and ductility while maintaining a multiphase structure that promotes the TRIP effect. These findings offer useful insights for optimizing heat treatments to improve the mechanical performance of TRIP steels in industrial applications.

Keywords: 304L TRIP steel; Heat treatment; Mechanical properties; Microstructure.

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5.15 Experimental and Numerical Characterization of Springback in V-Bending of AISI 304L Stainless Steel

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Abstract: This study investigates springback behavior in V-bending of AISI 304L stainless steel through both experimental measurements and finite element simulation. V-bending was performed using a universal testing machine at four different angles (30°, 45°, 60°, 90°). Post-unloading bend angles were measured using high-resolution imaging and analyzed with ImageJ software. Corresponding simulations were carried out using ABAQUS, employing elastoplastic material model validated by tensile tests. Results show a strong correlation between experiment and simulation, with maximum springback deviation occurring at 60° and 90° bends. These findings confirm the capability of numerical models in predicting angular accuracy in sheet metal forming.

Keywords: Springback; V-bending; ABAQUS; Stainless Steel.

ICESSE2025-ME-020

5.16 Flambement des plaques composites polymères à gradient fonctionnel renforcées par des nano plaquettes de graphène

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Résumé : Cette étude examine le comportement en flambement de plaques composites multicouches de nano plaquettes de graphène (GPL)/polymère à gradient fonctionnel à l'aide d'une nouvelle théorie des plaques raffinée d'ordre n . Cette théorie introduit un champ de déplacement polynomial d'ordre supérieur qui assure la cohérence variationnelle et élimine le recours à des facteurs de correction de cisaillement. Dans cette formulation, les contraintes de cisaillement varient de manière parabolique sur l'épaisseur de la plaque, et les conditions d'absence de contrainte sont satisfaites sur les surfaces supérieure et inférieure, ce qui améliore la précision par rapport aux théories de plaques conventionnelles. Une innovation clé de ces travaux réside dans la variation couche par couche des fractions pondérales de GPL, permettant la conception de nanocomposites à gradient fonctionnel présentant des motifs de renforcement uniformes et non uniformes, notamment FG-O. Le module de Young effectif est prédit à l'aide du modèle micromécanique de Halpin-Tsai, et la règle des mélanges est utilisée pour déterminer le coefficient de Poisson effectif et la masse volumique. Des solutions analytiques pour le flambement sont dérivées pour des plaques à appui simple grâce à la technique de solution de Navier.

Keywords : Nanoplaquettes de graphene (GPLs); Plaques nanocomposites; Composites polymères; théorie raffinée à quatre variables d'ordre n .

ICESSE2025-ME-021

5.17 Surface Engineering of AA2024 by TSA Anodizing: Temperature-Controlled Optimization of Anodic Film Properties

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Abstract: This study investigates the influence of anodizing temperature on the microstructural and electrochemical properties of anodic films formed on AA2024 alloy using a tartaric-sulfuric acid (TSA) electrolyte. Anodization was carried out at varying temperatures ranging from 5 °C to 25 °C. Surface morphology was analyzed using SEM and EDS. Results revealed that lower temperatures favored the formation of a more compact and homogeneous porous structure, while higher temperatures led to increased pore diameter and reduced layer density. Electrochemical test (CV) confirmed enhanced corrosion resistance for samples treated at lower temperatures, attributed to improved barrier layer integrity. This temperature-controlled approach in TSA anodizing offers a promising route for tailoring surface characteristics of aerospace-grade aluminum alloys, particularly in optimizing adhesion and corrosion protection for subsequent coating applications.

Keywords: Tartaric-sulfuric acid; AA2024 aluminum alloy; Anodizing temperature; Corrosion.

ICESSE2025-ME-022

5.18 Preparation and Characterization of PHBV/Lignin Biocomposites

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Abstract: In this work biocomposites films based on Poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) and lignin with were prepared by melt compounding. PHBV-g-MA was added as compatibilizer agent. Physical, optical, mechanical and thermomechanical properties were investigated through Fourier transform infrared (FTIR) spectroscopy, UV-Visible spectroscopy, tensile test and Dynamic Mechanical analysis (DMA). The thermal stability of materials was study thermogravimetric analysis (TGA). The results indicates that the incorporation for lignin and PHBV-g-MA lead to improvement of mechanical and thermomechanical properties of biocomposites. Through tensile test and DMA analysis the results indicated a significant increase in Young's modulus and tensile strength and storage modulus compared to neat polymer.

Keywords: *Biocomposite; Lignin; PHBV; PHBV-g-MA.*

ICESSE2025-ME-024

5.19 Numerical Modeling of Polyurethane Foam Behavior for the Design of Orthopedic Cushions

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Abstract: In a finite element (FE) simulation of the large deformation elastic response of elastomeric foams, the often-preferred model is the Ogden-Hill model, also known as Hyperfoam in Abaqus software, which uses a compressible hyperelastic model. This article primarily aims to examine the mechanical behavior of polyurethane (PU) foams, specifically focusing on their use in the manufacture of orthopedic cushions. The hyperfoam model is used to simulate the mechanical response of various foams with different densities (16 mg / cm³ and 25 mg / cm³). This model was first calibrated by optimizing experimental data from the literature, then it was subjected to a uniaxial compression test representing the patient's weight on the couch. The force-relaxation curves corresponding to each type were then extracted, and the behavioral phases in the compression of these foams, as well as the impact of density on stiffness, were identified.

Keywords : *Mousse élastomère ; Hyper élasticité ; Coussin orthopédique ; Simulation numérique Abaqus.*

ICESSE2025-ME-027

5.20 Stress Intensity Factor for an External Crack in an Elastic Layer Subjected to Torsion by Two Coaxial Rigid Discs

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Abstract: This study presents an analytical investigation of the Mode III stress intensity factor (SIF) for an external crack in an elastic layer under torsional loading. The layer is subjected to opposite rotations by two identical, coaxial rigid discs symmetrically bonded to its upper and lower surfaces. The problem is formulated as a mixed boundary value problem and reduced to a system of dual integral equations via the Hankel transform. Using Abel-type integral techniques, the system is transformed into a pair of Fredholm integral equations of the second kind, which are further reduced to an infinite system of algebraic equations via Jacobi polynomial series. Closed-form expressions for the SIF are then derived in terms of the solution of this algebraic system. The results offer valuable insights into torsion-induced fracture behaviour and serve as reliable benchmarks for validating numerical models in fracture mechanics.

Keywords: *Axisymmetric torsion; Elastic layer; External crack; Dual integral equations; Stress intensity factor.*

ICESSE2025-ME-028

5.21 Experimental and Numerical Investigation of Damage Evolution in 7075 Aluminum Alloy Under Oligocyclic Fatigue

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Abstract: This study examines oligocyclic fatigue of aluminum alloy 7075 using experimental and numerical analysis. Metallographic optical microscopy was used to examine surface damage. The microstructures of heat-treated specimens showed similar features, with irregularly shaped and varyingly sized elongated grains aligned in rolling direction. Comparatively large inclusions were seen, which seem to serve as surface micro-crack initiation sites. As fatigue cycles increase, these micro-cracks spread more widely and eventually cause fracture. To improve volumetric damage evolution's predictive accuracy, we use advanced numerical framework based on Lemaitre-Chaboche continuum damage mechanics. The model showed, damage variable displays accelerated growth during mid-life cycles along with progressive stress reduction due to material degradation, evolving nonlinearly from 0 (intact) to 1 (fracture). S-N curve shows characteristic decreasing slope in log-log scale characteristic, reflects this behavior, with fatigue strength decreasing as cycle count increases. Stress-strain relationship demonstrates progressive decrease in peak stress along with cumulative strain accumulation.

Keywords: Aluminum alloy 7075; Oligocyclic fatigue; Surface damage; Volumetric damage.

ICESSE2025-ME-029

5.22 Residual Stress Distribution under Central Laser Peening: Comparative FEA of AA2024-T351 Full and Quarter Discs

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Abstract: By inducing deep compressive residual stresses, Laser Shock Peening is widely employed to enhance the mechanical performance of high-strength aluminium alloys such as AA2024-T351. This study presents a comparative finite element analysis to evaluate the residual stress field induced by a single central laser pulse on both full and quarter-symmetry models of an AA2024-T351 disc. The simulations were performed using ABAQUS/Explicit with the Johnson–Cook constitutive model, accounting for strain-rate effects and high plastic strain gradients. A semi-parabolic pressure profile was applied to the disc's upper surface to simulate the transient shock. The results revealed notable differences between the models. The quarter disc underestimated both the peak compressive stress and its penetration depth compared to the full disc, which reached –400 MPa at 0.6 mm. Despite a 75% reduction in computational time, the quarter model proved less accurate. These findings highlight the need for full-domain modelling in high-fidelity LSP simulations.

Keywords: LSP; FEA; AA 2024-T351; Residual Stress.

ICESSE2025-ME-030

5.23 Analysis of the Influence of Recycled Fiber Content on the Mechanical Properties of a Polyester Resin

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Abstract: The recycling of thermoset composite materials (TC) represents a major challenge that researchers are striving to overcome. Due to their complex composition and the three-dimensional crosslinked nature of the resin, these materials are difficult to recover and properly recycle. In response to this issue, numerous studies are focusing on the valorization of this waste and its reintegration into new composite structures. In this work, we focused on studying the effect of incorporating ground glass fibers into an unsaturated polyester resin. Several composites reinforced with different proportions were tested in order to develop new high-performance composite materials. This approach aims to open new perspectives for reducing composite waste, which remains one of the main obstacles to their sustainable development.

Keywords: Thermoset composite; Glass fiber recycling; Mechanical properties; Behavior.

ICESSE2025-ME-032

5.24 Study of the effect of the singularity of the fiber orientation angle in a perforated composite plate on an aircraft wing

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Abstract: Stress concentration in an elastic body mainly results from localized forces or geometric discontinuities such as holes. In the case of aircraft wing ribs, the presence of cut-outs causes stress concentration that can reduce the mechanical strength of the structure. This work aims to analyze the distribution of stresses around and away from a hole in a plate under tension, using two laminated composite materials: glass/epoxy and carbon/epoxy. The focus is on determining the maximum stresses and the stress concentration factor. A parametric study was conducted to assess the impact of several parameters: hole size, fiber orientation (-90° to 90°), plate orientation (30° , 60° , 90°), and the distance between two holes. Numerical simulations performed in Abaqus show that these parameters strongly influence stress distribution and critical areas.

Keywords: Composite material; Stress distribution; Fiber orientations; Abaqus.

ICESSE2025-ME-034

5.25 Etude du comportement à l'arrachement des interfaces fibre/matrice

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Résumé : L'objectif principal de cette étude est de comprendre le comportement micromécanique des interfaces dans des matériaux composites à matrice polymère en utilisant le test d'arrachement (pull-out). Il est donc nécessaire de caractériser le comportement mécanique de la zone interfaciale de manière aussi détaillée que possible. Afin de résoudre le problème d'identification de la force de décohésion permettant la rupture de la liaison entre fibre et matrice. Dans ce but des essais d'arrachement de type pull-out ont été utilisés pour la caractérisation mécanique. L'analyse des résultats (propriétés mécaniques, mécanismes de la rupture) ont permis de mieux comprendre les micro-mécanismes d'interaction renfort / matrice et d'expliquer le comportement macroscopique à l'arrachement.

Keywords : Interface ; Composites ; Longueur utile ; Pull-out.

ICESSE2025-ME-035

5.26 Structural and electrochemical study of cathode materials for proton-conducting fuel cell

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Abstract: A new series of cathode materials with the general formula $\text{Sr}_{1-x}\text{M}_x\text{Fe}_{0.95}\text{Y}_{0.05}\text{O}_{3\pm\delta}$ (where $\text{M} = \text{Ca}^{2+}, \text{Ba}^{2+}, \text{Ni}^{2+}, \text{Bi}^{3+}$; $x = 0$ and 0.1) were successfully synthesized using the sol-gel method for application in proton-conducting fuel cells. Structural characterization via X-ray diffraction (XRD) revealed that all samples crystallize predominantly in the tetragonal system with space group I4/mmm , confirming the formation of the main $\text{SrFeO}_{3\pm\delta}$ phase. Minor traces of a secondary phase, $\text{Sr}_3\text{Fe}_2\text{O}_{7\pm\delta}$, were also observed. Notably, the Ni^{2+} -doped sample exhibited the highest phase purity, with a volume fraction of 98.20%, and the lowest refinement agreement factors ($R_p = 1.2$, $R_{wp} = 1.99$), indicating high crystallographic quality. Electrochemical behavior was investigated at room temperature (25°C) in 0.5 M NaOH alkaline solution using impedance spectroscopy, cyclic voltammetry (CV), Mott-Schottky analysis, and chronopotentiometry. The doped samples exhibited significantly enhanced electrochemical performance compared to the undoped material. CV measurements demonstrated increased current responses and improved redox reversibility, particularly for the Ba^{2+} - and Ni^{2+} -doped electrodes. Nyquist plots revealed a substantial decrease in the real part of impedance (Z') at low frequencies for these samples, indicating enhanced charge transfer kinetics and improved diffusion processes. Mott-Schottky analysis confirmed that all samples behaved as p-type semiconductors, with the lowest flat band potential measured at 0.15 V vs. SCE. Furthermore, the charge carrier density reached values as high as $4.75 \times 10^{18}\text{ site}\cdot\text{cm}^{-3}$ for the Bi^{3+} - and Ba^{2+} -doped samples.

Keywords: Sol-gel synthesis; Doping; Structural; Electrochemical measurements.

ICESSE2025-ME-036

5.27 Fatigue Behavior of Multifunctional Composites with Embedded Metallic Inserts: Influence of Insert Thickness

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Abstract: This study investigates the tensile and fatigue behavior of glass fiber/epoxy composites with embedded copper foil strips (0.05mm and 0.1mm thick), denoted GFC0.05 and GFC0.1. Tensile tests revealed that Maximum Tensile Resistance (MTR) decreases with increased insert thickness (277 MPa for GFC0.05 vs. 270 MPa for GFC0.1) due to parasitic stresses from stiffness mismatch. Fatigue testing under electrical monitoring (9V) showed failure is initiated by copper rupture. The insert thickness critically influences performance: GFC0.1 outperforms at high stress levels (80% and 65% MTR), while GFC0.05 is superior at 50% MTR. A fatigue endurance limit is identified. SEM analysis of recovered copper confirmed ductile-brittle fracture mechanisms correlating with stress levels.

Keywords: Multifunctional composite material; Fatigue; Metallic insert; De-bonding.

ICESSE2025-ME-037

5.28 Evaluation of a Natural Calcium Carbonate for Bone Substitution.

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Abstract: A key issue in orthopaedic surgery and traumatology is the replacement of lost bone. In many cases, bone grafting is necessary, requiring the use of bone replacement biomaterials. A bone substitute must possess a number of characteristics, including good biological properties and sufficient strength and mechanical properties. This work aims to characterize a natural source of calcium carbonate (CaCO_3) derived from cowrie shells for use as a bone filling substitute. Mechanical characterization was carried out on cylinders 10 mm in diameter and 10 mm in height to perform compression measurements under the influence of heat treatments at different temperatures (between 450 and 550°C) in order to determine compressive strength and Young's modulus, as well as porosity measurements. The results showed that the sample treated at 450 °C shows the highest compressive strength, while the greatest Young's modulus is found at 500 °C.

Keywords: *Biomaterials; Calcium carbonate; Mechanical investigations; Bone substitution.*

ICESSE2025-ME-038

5.29 Machine Learning and Genetic Algorithm Optimisation of CO₂ Uptake in Porous Organic Polymers

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Abstract: Porous organic polymers (POPs) are promising candidates for CO₂ capture due to their tunable porosity and structural versatility. A machine learning framework was developed to predict and optimize the CO₂ adsorption capacity of POPs using 190 experimental data points with features including surface area, pore volume, porosity, temperature, and pressure. Models tested included Random Forest, Gradient Boosting, Support Vector Regression, Artificial Neural Network, and an ensemble RF+GB. Gradient Boosting achieved the highest accuracy ($R^2 = 0.963$, MAE = 0.166). Feature importance and SHAP analysis confirmed pressure and temperature as the most decisive factors, with surface area contributing moderately. To enhance uptake, a Genetic Algorithm was coupled with the ML model, predicting maximum uptakes of 4.5 mmol/g at 273 K and 3.4 mmol/g at 298 K. The integrated ML-GA approach provides a powerful tool for screening and rational design of advanced adsorbents for carbon capture.

Keywords: *Machine Learning; Carbon capture; Optimisation; Porous organic polymers.*

ICESSE2025-ME-39

5.30 Comportement à l'impact faible vitesse des matériaux composites verre/polyester

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Résumé : Dans ce travail nous présentons une étude expérimentale de l'effet de défauts mésoscopiques de boucles et du cisaillement du renfort, qui se résultent de la mise en forme, sur le comportement à l'impact faible vitesse d'un composites verre/polyester. Ce composite verre/polyester est constitué de trois couches de mat et une couche de tissu taffetas. Des plaques saines, et avec défauts et déformations calibrés, ont été élaborées dans le but d'évaluer les propriétés induites sur composite finale. Les essais d'impacts et observations réalisés sur les plaques avec défauts et déformations calibrés ont permis d'identifier un effet négatif des défauts mésoscopiques sur les paramètres élastiques et ont révélés un endommagement plus important relativement au matériau sain. Le cisaillement du renfort quant à lui a eu un effet bénéfique sur les propriétés à l'impact du stratifié ce qui a été attribué à l'augmentation de la densité locale de fibre.

Keywords : Stratifié ; Textiles ; Défauts ; Impact.

ICESSE2025-ME-40

5.31 Analyse de la qualité des perçages des matériaux composites verre/polyester.

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Résumé : Le perçage des matériaux composites à matrice polymère (verre / polystyrene insaturée) constitue un défi majeur en raison des endommagements susceptible de produire à différentes zones du perçage. Ces dégradations se manifestent principalement par l'écaillage et le délaminage à l'entrée, les détériorations des parois interne (état de surface), ainsi que les arrachements des fibres et fissures à la sortie du trou, affectant ainsi la qualité d'usinage et les performances mécaniques de la structure. Dans notre travail nous avons utilisé trois géométries de l'outil pour deux diamètres, trois vitesses de coupes ainsi que différentes vitesses d'avances.

Après réalisation des essais et analyse des résultats nous sommes arrivés à une conclusion de la géométrie de l'outil et conditions de coupe de la meilleure qualité du perçage.

Keywords : Composites ; Outils de coupes ; Perçage ; Effort de coupe ; Délaminage.

6. Hydraulic Engineering

ICESSE2025-HE-001

6.1 Development of an Assessment Framework of Numerical Schemes Performance (Dam Break)

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Abstract: The resolution of free-surface flow equations relies on the use of suitable numerical schemes. Indeed, different researchers and evaluated using performance criteria, such as accuracy and comparison with other models, have developed several schemes without taking into account other important assessment criteria. However, these approaches have certain limitations, in particular due to the lack of an overall framework for assessing the performance of numerical schemes. In this context, the aim of this study is to develop an assessment tool based on performance indicators to assess the overall performance of numerical schemes. The methodology used to build this model is based on two approaches: the first concerns the construction of the evaluation elements (objectives, criteria and indicators), and the second is the evaluation process for the elements constructed. This article focuses on the first stage of the methodology, i.e. the development of the elements making up the evaluation tool.

Keywords: Numerical scheme; Performance Indicator; Assessment; Dam break.

ICESSE2025-HE-002

6.2 Rehabilitation Planning of the Drinking Water Supply Network : Case Study of Tizi Ouzou, Algeria

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Abstract: In Algeria, Failures in the Drinking Water Supply Networks (DWSN) present a complex and costly problem. Consequently, network managers need to draw up a rehabilitation plan to keep the network in good condition. For this, our work focuses on the development of a rehabilitation tool for DWSN in the Mechtras region located in the City of Tizi Ouzou. Our study is based on a scheme for prioritizing drinking water supply pipes for rehabilitation, developed using the AHP-PROMETHEE II methods. This methodology integrates several criteria representing the different characteristics of DWSN pipes. These criteria are adapted to the managers strategies and the practical data available. The hierarchical analysis process (AHP) is used to determine the weights of the criteria, while the PROMETHEE II method is used to obtain the final ranking of the pipelines.

Keywords: AHP; Drinking water supply network; Pipe prioritization; PROMETHEE II; Rehabilitation.

ICESSE2025-HE-003

6.3 Impact of Aperture Distribution on Particle Transport and Deposition in Fractured Media: A Numerical Study

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Abstract: This study presents a numerical investigation of particle transport through a single fracture with variable aperture distribution using a 3D model. To replicate the natural variability observed in geological fractures, the fracture model is constructed in a 3D space with apertures following various statistical distributions, including uniform and log-normal distributions. A particle tracing module is included to examine the trajectories and deposition of particles. The findings revealed that particles tend to follow predictable flow paths in uniform aperture distribution, leading to more uniform deposition along the fracture walls. Conversely, in fractures with log-normal aperture distributions, the variability in aperture size generates preferred flow paths, resulting in more complex transport behavior. More homogeneous distributions result in more mixing and spreading of the particles. The simulations also show that the influence of aperture variability is reduced under high-flow velocity conditions; particles exhibit more homogeneous transport, regardless of their distribution.

Keywords : Particle transport ; Aperture distribution ; Deposition ; Dispersion.

ICESSE2025-HE-004

6.4 Méthode de LAX à pas Fractionnaire pour la Simulation d'un Ecoulement Induit par la Rupture d'un Barrage

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Résumé : La rupture de barrage, définie comme une libération incontrôlée d'eau, engendre une inondation rapide et violente en aval, d'autant plus destructrice que le volume stocké est important. De nombreuses approches ont été développées pour étudier ce phénomène. Cet article présente une simulation numérique de la propagation de l'onde de crue due à une rupture de barrage, en considérant un écoulement instationnaire unidimensionnel. Le système des équations de Saint-Venant est résolu à l'aide d'une méthode numérique à pas fractionnaire. La validation est assurée par comparaison avec des données expérimentales et des résultats antérieurs. Le dispositif expérimental comprend un réservoir amont, un canal sec horizontal, un obstacle triangulaire à forte pente, et une zone aval avec nappe au repos et diaphragme vertical. Les résultats obtenus montrent une excellente concordance, confirmant la robustesse du schéma proposé.

Keywords : Ecoulement ; onde de crue ; Saint-Venant ; Lax à pas fractionnaire.

ICESSE2025-HE-005

6.5 Physico-chemical characterization of aluminium hydroxide sludge from a water treatment plant and its use as an adsorbent for the removal of Congo red dye from aqueous solutions

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Abstract: This study investigates the potential reuse of sludge produced by water treatment plants, typically disposed of in landfills, as a low-cost sorbent for removing pollutants such as heavy metals and dyes from wastewater. Sludge samples collected from the Hammam Dabbagh water treatment plant in Guelma, Algeria, were characterised using XRD, XRF, laser granulometry, SEM, and TOC. The analysis showed that the sludge is mainly composed of aluminium and iron, with dominant mineral phases including calcite, quartz, kaolinite, anatase, and aluminium silicates. These components suggest strong flocculation and adsorption potential. Preliminary adsorption tests using Congo Red dye demonstrated encouraging removal efficiency, confirming the sludge's potential application in wastewater treatment. The results highlight the possibility of valorising water treatment sludge, contributing to sustainable waste management practices and reducing environmental pollution.

Keywords: Aluminium hydroxide sludge; Characterisation; Congo Red; Valorisation; Wastewater treatment

ICESSE2025-HE-006

6.6 DBD-Based Ozonated Water System for Fruit and Vegetable Washing: Performance Optimization and Quality Preservation

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Abstract: This study investigates the application of dielectric barrier discharge (DBD) technology for generating ozonated water as an innovative washing medium for fresh produce decontamination. A coaxial DBD reactor was designed and optimized, featuring an aluminum foil inner electrode, glass dielectric barrier (50 mm outer diameter, 2 mm thickness), and stainless steel outer electrode with a 1 mm discharge gap. The system achieved maximum ozone concentration of 118 mg/L at optimal operating conditions of 7.5 kV applied voltage, with peak energy efficiency of 345 g/kWh. Experimental validation using oranges and zucchini demonstrated that ozonated water treatment (25 mg/L dissolved ozone, 5-second exposure) effectively extended shelf life to 14 days compared to control samples, which showed significant deterioration after one week. The brief ozone exposure provided optimal antimicrobial efficacy while preserving product quality, whereas longer treatment times (15-30 seconds) showed diminishing returns.

Keywords: ozone generation; DBD; water treatment; Fruit and vegetable washing; Energy efficiency.

ICESSE2025-HE-008

6.7 Évaluation expérimentale de l'influence de la rugosité sur la longueur du rouleau de surface d'un ressaut hydraulique en canal rectangulaire

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Résumé : Cette étude présente une analyse expérimentale de l'effet de la rugosité sur la longueur du rouleau de surface d'un ressaut hydraulique formé dans un canal rectangulaire. Les essais ont été réalisés dans un canal horizontal équipé de revêtements rugueux de diamètres variés. Les résultats expérimentaux obtenus ont été exploités à travers différentes représentations graphiques, permettant de faire ressortir des relations adimensionnelles significatives. À partir de ces résultats, des corrélations empiriques ont été établies, combinant des paramètres dimensionnels et sans dimension. Ces formules se distinguent par un bon coefficient de corrélation, ce qui atteste de leur fiabilité. Les résultats montrent que l'augmentation de la rugosité réduit sensiblement la longueur du rouleau de surface, indiquant une dissipation d'énergie plus efficace. Ces observations contribuent à une meilleure compréhension du comportement des ressauts hydrauliques en conditions rugueuses, et fournissent des outils utiles pour la conception optimisée des dispositifs dissipateurs d'énergie dans les ouvrages hydrauliques.

Keywords : Ressaut hydraulique ; Canal rectangulaire ; Rugosité ; Longueur du rouleau.

ICESSE2025-HE-010

6.8 A Hybrid Mcdm Approach for Sanitation Maintenance

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Abstract: The management of sanitation networks is increasingly challenging due to the aging of urban infrastructure and the high costs associated with maintenance. This study proposes a decision support model aimed at helping sanitation service managers prioritize maintenance interventions according to the level of pipeline degradation. The methodology combines two multi-criteria decision-making techniques: The Fuzzy Analytic Hierarchy Process (FAHP) and the PROMETHEE II method. FAHP is used to determine the relative importance of evaluation criteria, with the collapse criterion emerging as the most significant (30.74%), followed by structural defects (17.27%). PROMETHEE II is then applied to rank the network segments, identifying manifold No. 2 as the top priority (29.14%), followed by manifold No. 10 (13.28%). The integration of FAHP and PROMETHEE II provides a robust and practical approach for improving decision-making in the maintenance and management of sanitation infrastructure.

Keywords: FAHP; Management; Maintenance; PROMETHEE II

ICESSE2025-HE-012

6.9 Evaluation of Rainfall Erosivity Factor (R) Using Alternative Models: The case of Oued Isser watershed, Algeria

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Abstract: This study aims to estimate the rainfall erosivity factor (R) in the Oued Isser watershed, located in northern Algeria, using two empirical models adapted to Mediterranean conditions. The first model is based on the Modified Fournier Index (Arnoldus), which incorporates monthly precipitation data, while the second model uses a simplified equation based on annual rainfall. Rainfall data from 2000 to 2003 were processed and spatially analysed using ArcGIS 10.8 to produce maps of R distribution. The results highlight spatial and interannual variability in rainfall erosivity across the watershed. These findings provide a preliminary understanding of erosive rainfall patterns in the region and offer a basis for future studies focused on erosion risk assessment and soil conservation planning.

Keywords: Rainfall erosivity; precipitations; Oued Isser; ArcGIS

ICESSE2025-HE-013

6.10 Analyse et Amélioration de la Distribution de l'Eau Potable dans la Wilaya de Bejaïa, Algérie

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Résumé : La distribution d'eau potable dans la wilaya de Béjaïa représente un enjeu majeur, en raison de la croissance démographique, des impacts du changement climatique et des faiblesses techniques du réseau. Malgré un potentiel hydrique important issu des barrages, des forages et des sources naturelles, la région connaît des inégalités d'accès et une couverture irrégulière entre les communes. Cette étude porte sur 17 communes et s'appuie sur les données fournies par l'Algérienne des Eaux (ADE) pour analyser les écarts de dotation et de fréquence de distribution. L'analyse met en évidence les disparités territoriales et les pertes importantes dans les réseaux. Elle vise à identifier les défaillances du système actuel et à formuler des recommandations concrètes pour une gestion plus rationnelle, équitable et durable de la ressource. Parmi les pistes proposées figurent la modernisation des infrastructures, la diversification des sources et la décentralisation de la gestion au niveau local.

Mots clés : Eau potable ; Distribution ; Gestion hydriques ; Inégalités ; Wilaya de Béjaïa.

ICESSE2025-HE-014

6.11 Numerical investigation of Free-Surface Flow in Channels with Geometric Transitions

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Abstract: This study investigates turbulent free-surface flows in channels with geometric singularities (contractions/expansions) using advanced numerical modeling. We employ ANSYS Fluent and OpenFOAM with finite volume methods to solve incompressible Navier-Stokes equations, incorporating the SST k- ω turbulence model and VOF method for surface tracking. Two configurations are analyzed: symmetric contraction and Rouse expansion. Results demonstrate strong agreement with experimental data (Coles & Shintaku, 1943) and prior numerical studies (Bhallamudi & Chaudhry, 1992), particularly in predicting hydraulic jumps. This work provides validated methodologies for optimizing hydraulic structures with geometric transitions.

Keywords: Channel transitions; VOF method; CFD;

ICESSE2025-HE-015

6.12 Etude numérique d'infiltrations à travers la digue des barrages en terre

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Résumé : Dans le cadre de ce travail, nous nous sommes intéressés à la simulation numérique des infiltrations dans les barrages en terre. Pour cela, nous avons élaboré des modèles numériques en utilisant le code de calcul Ansys Fluent. Les équations de Navier-Stokes modifiées par l'ajout d'un terme source afin de représenter les pertes de charge spécifiques aux milieux poreux sont résolues avec la méthode des volumes finis. Le modèle VOF (Volume of Fluid) est employé pour suivre l'interface air-eau et déterminer la ligne de saturation. Les résultats numériques sont validés par comparaison avec les méthodes analytiques de Kozeny et de Pavlovsky, montrant une bonne concordance. L'analyse met en évidence l'impact critique de la perméabilité du corps du barrage et du drain ainsi que la porosité du drain sur la position de la ligne de saturation. Les résultats obtenus soulignent l'importance d'optimiser les propriétés hydrauliques des matériaux afin d'assurer la stabilité des barrages.

Keywords : ANSYS Fluent ; Ligne de saturation ; Barrages en terre ; Infiltration

ICESSE2025-HE-016.

6.13 Machine Learning Approaches for Daily Runoff Forecasting in Semi-Arid Regions: A Case Study of Oued Boukdir, Algeria

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Abstract: Flash floods pose a significant threat in arid and semi-arid regions, putting lives, property, and infrastructure at risk. This study focuses on modeling and forecasting flash floods in the Oued Boukdir watershed in northern Algeria using artificial intelligence techniques. Two machine learning approaches Feedforward Neural Network (FFNN) and Extreme Learning Machine (ELM) were compared for predicting daily streamflow based on precipitation data. Model performance was evaluated using the Modified Kling-Gupta Efficiency (MKGE), Nash-Sutcliffe Efficiency (NSE), and coefficient of determination (R^2) during both training and testing phases. The FFNN model achieved MKGE values of 0.93 in training and 0.87 in testing, while the ELM model reached MKGE values of 0.78 and 0.82, respectively. These results demonstrate that both models are effective for runoff prediction, with FFNN providing higher accuracy and ELM offering faster training, highlighting the potential of artificial intelligence for enhancing flood risk management and early warning systems.

Keywords: machine learning; Feedforward Neural Network; Extreme Learning Machine; arid and semi-arid.

ICESSE2025-HE-017

6.14 Calcul numérique du profil de la surface d'eau dans une transition hydraulique d'un coursier d'évacuateur de crue

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Résumé : L'objectif du présent travail de recherche est l'étude du cas d'une structure hydraulique non prismatique à forte pente. Cette dernière est l'une des principales parties d'un coursier d'évacuateur de crue à ciel ouvert. L'écoulement dans un rétrécissement est assez dangereux du point de vue phénomène hydraulique. La complexité est accentuée si cet écoulement est du type 2D, instationnaire et supercritique. Les quelques études, rares d'ailleurs, effectuées dans cet axe de recherche concernent seulement une structure sans pente. Ainsi, l'idée ici est de traiter le cas de l'effet de la pente sur la forme de la surface libre dans la structure étudiée. L'écoulement est régi par les équations de Saint-Venant généralisées. Elles sont résolues numériquement moyennant le schéma aux différences finies explicite de Gabutti. Le cas d'un rétrécissement rectiligne est traité.

Mots clés : Ondes transversales ; Saint-Venant ; Gabutti ; Rétrécissement.

ICESSE2025-HE-018

6.15 Typologies des Bassins Hydrauliques de l'Aqueduc Antique de Tiklat

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Abstract : La cité romaine de Tubusuptu (Tiklat) possédait un système hydraulique très complexe. Elle est alimentée par deux aqueducs, le premier sur la rive droite de la Soummam, le deuxième sur la rive gauche. Ce dernier captait les eaux des hauteurs de Fénéaia et les achemine vers les citernes d'El Arouia. Cette étude s'intéresse aux typologies des bassins de la rive gauche et à leurs rôles dans la régulation, la décantation ou la gestion des flux d'eau dans un environnement à fortes contraintes topographique. Plusieurs types de bassins ont été identifiés : bassins ovales, disposés tantôt parallèlement, tantôt perpendiculairement au canal principal, bassins circulaires, bassins rectangulaire et carrée. L'analyse repose sur des relevés topographiques, des fouilles ciblées, une relecture critique des sources historiques et une approche technique inspirée des travaux de Chanson sur l'hydraulique antique.

Keywords : Aqueduc ; Ouvrages hydrauliques ; Bassins ; Approche technique.

ICESSE2025-HE-021

6.16 Évaluation géospatiale du potentiel érosif par intégration du SPI et des dynamiques d'occupation du sol (cas du bassin versant d'Oued El Hachem)

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Résumé : Cette étude identifie les zones à fort potentiel érosif dans le bassin versant de l'oued El-Hachem (Algérie), à travers une analyse spatiale intégrée, combinant l'indice de puissance spécifique (SPI) et les dynamiques d'occupation du sol entre 1990 et 2022. L'analyse révèle que 35,5 % du territoire a connu des changements d'usage, principalement par conversion de forêts et broussailles en terres agricoles. Toutefois, seulement 2,7 % de la superficie totale présente à la fois une instabilité d'occupation et un SPI élevé, ce qui explique le faible taux d'envasement du barrage de Boukourdane. La topographie du bassin agit comme une barrière naturelle au transport sédimentaire vers la retenue. L'approche méthodologique mobilisée repose sur des outils SIG reproductibles, adaptés aux contextes méditerranéens. Elle permet de cibler les zones à risque pour optimiser les stratégies de conservation des sols et mieux comprendre les liens entre usage du sol, morphologie et sensibilité à l'érosion dans les milieux vulnérables.

Keywords : LULC ; SPI ; Risque érosif ; Superposition

7. Energy Efficiency

ICESSE2025-EE-001

7.1 Optimizing Thermal Management: Hybrid Nanofluids, MHD Control, and Integrated Heat Transfer Analysis

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Abstract: This numerical study examines natural convection of a hybrid nanofluid in a square enclosure under a horizontal magnetic field. Four heat-generating blocks are inside. Vertical walls are cooled, others insulated. Buoyancy and the damping magnetic force drive flow and heat transfer. Governing equations (mass, momentum, energy) with Boussinesq approximation are solved via the finite volume method and SIMPLE algorithm. Results are presented as streamlines, isotherms, and graphs to analyze the Rayleigh number (Ra), Hartmann number (Ha), nanoparticle volume fraction (ϕ), and local/average Nusselt numbers (Nu).

Keywords: MHD; Heat source; Square cavity; nanofluid

ICESSE2025-EE-005

7.2 Numerical Study under Fluent Software and Optimization of Compact Finned Exchangers

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Abstract: This work consists of performing a numerical simulation under Fluent to first study the thermal fields around a single fin and then a study on several fins. Another study on the effect of some parameters, such as thickness, length, and spacing between the fins is carried out on Fluent. First, a description of the study was presented. Next, we observed the flow phenomena around the fins, for different Reynolds numbers. Then, we compared the results obtained on the fin surface. Subsequently, an analysis of the flow phenomena in the wake of the fin was performed. The results show that reducing the fin length improves thermal performance. A compromise was found, with fin lengths of $l_s = 2-3$ mm for low Reynolds numbers ($Re = 120$) and lengths of $l_s = 3-5$ mm for higher Reynolds numbers ($Re = 360$). The velocity and temperature profiles along the fin show the development of the boundary layer on a thick plate. A recirculation zone with negative velocities is observed, followed by the typical boundary layer development. The results show that all these parameters strongly influence the temperature field around the fins. The results again demonstrate good agreement between our numerical results and previous studies.

Keywords: Heat Transfer; Heat Exchanger; CFD; Strouel Number.

ICESSE2025-EE-008

7.3 Influence de la Surface du Capteur solaire sur les Performances d'une Installation de froid Solaire

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Abstract: This article presents a model for studying a three-temperature absorption refrigeration machine, operating with H₂O/LiBr and powered by solar collectors. This system is an alternative to conventional solutions, designed with a view to preserving the environment and reducing the energy consumption of buildings. The various components of the installation were modeled and then implemented in the TRNSYS object-oriented simulation environment. The mathematical model is based on the principles of thermodynamics and on the heat and mass transfer equations applied to the refrigeration cycle. The study focuses in particular on the variability of the solar collection surface, a key parameter *for predicting the performance of the installation in transient conditions*.

Keywords : Capteur thermique ; Machine à absorption ; Bromure de Lithium ; Trnsys.

ICESSE2025-EE-012

7.4 Enhanced Funnel Control Strategies for Wind Turbine Speed Regulation" FC Asymmetric with scaling

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Abstract: This work evaluates the performance of a Funnel Controller with scaling gain applied to a wind turbine speed control system. A classical Funnel Controller is compared with several scaled versions using a simple linear turbine model. Simulation results show that increasing the scaling gain significantly reduces rise time, settling time, and tracking error. Error metrics such as IAE, ITAE, MSE, RMSE, and AMSE all confirm the improved control quality. The scaled controller achieves faster and more accurate performance while maintaining stability. This approach enhances the tracking of reference speed and optimizes aerodynamic efficiency, making it suitable for practical wind energy applications.

Keywords: Funnel control; wind turbine; Funnel boundary; Scaling gain.

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7.5 Green refrigeration with CO₂ at very low temperature by using the natural gas expansion

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Abstract: This work consists of the study of a cold storage system whose production is ensured by the recovery of energy from natural gas expansion stations, which are found at the entrance of each city here in Algeria. The purpose is to convert the energy recovered during expansion into refrigerating power thanks to another installation using CO₂ as a refrigerant. The idea is to install turbo-expanders in the expansion stations, which will allow the recovery of the expansion energy of the natural gas and use it in a secondary circuit, here is a refrigeration installation, thus achieving a COP greater than 1 for an evaporating temperature of -50°C. According to forecasts, the refrigeration capacities produced vary from a few kilotons for small towns to several megatons for large cities. The COP of the system is evaluated based on the expander inlet temperatures.

Keywords: Natural gas expander; COP; Green cooling.

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7.6 Numerical Investigation of Innovative Shell and Tube Configurations: Improving Heat Transfer and Hydraulic Performance

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Abstract: This study compares the performance of four heat exchangers, which will be divided into two stages to optimize outcomes. First, a comparison is made between a shell-and-tube heat exchanger with a 25% baffle cut and tubes with different cross sections: circular (STHE-CT), elliptical with a 90° attack angle (STHE-ET90°), and elliptical with a 0° attack angle (STHE-ET0°). This comparison is based on a numerical analysis at the same flow rate; therefore, ANSYS Fluent was used to perform a three-dimensional computational study. The results revealed that the STHE-ET90° has the highest overall heat transfer coefficient. The second comparison is between the STHE-ET90° and heat exchangers with triple-layer flower baffles and ellipsoidal tubes with an attack angle of 90° (STHE-FB-ET90°). Temperatures, pressure drop on the tube, and shell sides are also examined for each study case.

Keywords: Heat exchanger; Temperature drop; Pressuredrop; CFD.

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7.7 Les Systèmes de Gestion Technique Informatisée Comme Levier de l'Efficacité Énergétique dans l'Espace Résidentiel en Algérie

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Abstract : L'avancée technologique a permis le développement de nouveaux systèmes fonctionnant avec des composants mécaniques, électroniques et programmes informatiques, permettant la promotion de l'efficacité énergétique dans l'espace résidentiel. Ces systèmes peuvent agir indépendamment d'une intervention humaine et réguler les consommations énergétiques en fonction des paramètres préétablies, mais aussi, d'informer et de contrôler en temps réel respectivement sur les consommations énergétiques et le fonctionnement des équipements. La revue narrative réalisée nous renseigne que l'appropriation de ses systèmes contribuent indéniablement à l'amélioration de l'efficacité énergétique et minimise l'impact environnemental. Il existe plusieurs dispositifs tels que le vitrage électrochrome intelligent, les smart grids, des appareils capteurs des paramètres environnementaux ou actionneurs d'ordres permettant d'ajuster les ambiances selon des attentes préétablies, qui intègrent les domaines de la domotique et l'immutique, réputés pour leurs avantages d'optimisation de gestion, d'économie, de sécurité, de confort et de respect de l'environnement.

Keywords : Systèmes ; Efficacité énergétique ; Espace résidentiel ; Impact environnementale.

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7.8 Assessing the Influence of Building Shape and Compactness on Energy Efficiency Using EnergyPlus and BIM Workflow

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Abstract: This study explores the potential of biomimetic architecture, specifically hexagonal building shapes, inspired by honeycomb cells, to enhance energy efficiency and sustainability in hot and arid climates. Motivated by the growing emphasis on green and ecological design, the research compares traditional building geometries with hexagonal forms, focusing on key parameters such as energy consumption and CO₂ emissions. The findings reveal that adopting a hexagonal shape can reduce primary energy consumption by 48% and CO₂ emissions by 14%, while also optimizing material use and maximizing usable interior space. The compact geometry minimizes thermal exchange surfaces, reducing energy losses and improving indoor comfort. This approach offers a promising strategy for addressing contemporary environmental challenges in the building sector. By integrating principles from natural structures, the study highlights how biomimicry can contribute to sustainable, high-performance architectural solutions, reshaping future building practices toward greener, more efficient designs.

Keywords: Sustainable building; Energy simulation; Compactness; Building Information Modeling.

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7.9 Numerical modeling of the heat transfer within internal combustion engine valve's

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Abstract: Concentrated Valves in internal combustion engines play a critical role in engine operation, responsible for regulating the inflow and outflow of gases. These valves are exposed to significant thermal loads due to the high temperatures and pressures within the combustion chamber. The present study aims predict the temperature distributions in intake and exhaust valves under realistic engine operating conditions and using basic knowledge of the heat transfer and some empirical correlations. To achieve this, the geometry of the valve is adequately subdivided to better assess the thermal effect of each part of the cylinder head. The instantaneous heat transfer coefficient and the adiabatic wall temperature are determined for each subdivision throughout the engine's four-stroke cycle. The computed average values are imposed as boundary conditions in an ANSYS-based finite element model to perform unsteady thermal simulations. The developed model is used to highlight the temperature distribution of the both exhaust and intake valves under various operating conditions. It also identifies zones with high thermal gradients, allowing the localization of maximum temperature, which is essential to help automotive manufacturers to prevent valve failures.

Keywords: Exhaust/intake valves; Internal combustion engine; Heat transfer coefficient; Adiabatic wall temperature.

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7.10 Effects of Radiation on Instability in Thermal Stagnation Point Flow

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Abstract: The study aims to analyze the linear stability of a boundary layer flow in the vicinity of a stagnation point. Taking into account radiation effects. First, the basic flow equations are solved and then the linear stability is studied by solving the system of perturbed equations, which is an eigenvalue problem, using the pseudo-spectral collocation method of Laguerre. In order to establish the critical conditions for the appearance of instabilities and the stabilizing and destabilizing factors. The results are presented in the form of marginal stability curves in the Grashof number–wavenumber plane. Shows that the thermal radiation effect acts to expand the stability region when the wave number is very low and destabilize when the wave number is very high

Keywords: Thermal instability; Stagnation point; Radiation effect; Laguerre polynomial.

ICESSE2025-EE-021

7.11 Lubrication Analysis of Axisymmetric Squeeze Flow in Couple-Stress Fluids under Constant Squeeze Velocity

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Abstract: An axisymmetric two-dimensional flow of a couple-stress fluid between coaxial parallel discs subjected to a constant squeezing velocity is studied using the lubrication approximation. The couple stress momentum equations are discretised and solved by finite differences, and the influence of the couple stress parameter on velocity profiles, pressure build-up and load-carrying capacity is quantified. The results show that higher values of couple-stress amplify pressure and load capacity. The numerical scheme matches the analytical references with high accuracy, providing a reliable tool for the design of systems lubricated with non-Newtonian fluids.

Keywords: Squeeze Flow; Couple Stress Fluid; Finite Difference Method; Lubrication.

ICESSE2025-EE-022

7.12 Valorisation Energétique des Gaz d'Echappement des Turbines à Gaz : Vers une Amélioration de l'Efficacité et une Réduction des Emissions de CO₂

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Résumé : Dans cette étude, nous démontrons la capacité d'une version modifiée du cycle d'une turbine à gaz à augmenter son efficacité thermique et réduire ses émissions. La version modifiée est basée sur l'intégration d'un réchauffeur air-gaz. L'étude a d'abord porté sur le cycle simple puis sur la version modifiée du cycle. Des simulations effectuées sous MATLAB ont permis de comparer les performances des deux configurations. Afin de mieux comprendre le comportement de cette technologie et d'optimiser son intégration, nous analysons l'influence de certains paramètres clés tels que : l'efficacité du récupérateur, la température ambiante, le taux de compression et la température à l'entrée de la turbine. Les résultats montrent que l'intégration du récupérateur permet d'améliorer le rendement thermique de 24,8 % et de réduire les émissions de CO₂ de 29,7 %. Cette solution, ne nécessitant ni eau ni produits chimiques, s'avère particulièrement adaptée aux contraintes climatiques et techniques du site.

Keywords : turbine à gaz ; récupération de chaleur ; efficacité ; CO₂.

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7.13 Thermo-solutal instability in rotating disc flow

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Abstract: The thermosolutal instability of a three-dimensional steady laminar flow stagnation point flow over a radially heated rotating disk is investigated. The main objective of the current study was to improve three-dimensional instability analysis, which can coexist with small-scale disturbances in momentum, heat and mass transport processes. The position of the problem imposes first to examine the basic flow. In second part, based on Görtler-Hammerlin's normal modes, the pseudo-spectral method based on Laguerre polynomial expansion is applied to resolve numerically the obtained mathematical system, which constitutes an eigenvalue problem. Neutral curves and critical conditions under the study are reported to analyze instabilities that occur after loss of stability. Our computed results mainly interpret that mass transfer acts considerably to stabilize the base flow when mass and thermal buoyancy forces are opposed

Keywords: Linear stability; Rotating disc; Pseudo spectral; Buoyancy forces.

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7.14 Simulation of the Impact of Glass Cracking and Dust Accumulation on the Performance Degradation of Photovoltaic Modules

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Abstract: In the photovoltaic field, glass plays a crucial role as a protective layer for solar cells. However, the cracking of this glass whether caused by mechanical shocks (hail, transportation), thermal stresses (temperature variations), or natural aging leads to a significant degradation in panel performance. These cracks reduce the amount of light transmitted to the cells, directly lowering energy production. They also promote moisture and dust and the formation of hot spots, which can further damage the module. In this study, we investigated the combined effects of glass cracking and dust accumulation, specifically calcium carbonate (CaCO₃) on the performance of photovoltaic systems. The results demonstrate that when cracked PV modules are not regularly cleaned, their power output can degrade by more than 70%. This significant loss is not only due to the mechanical damage caused by the cracks but is also amplified by the infiltration of dust particles. Over time, these particles lead to secondary degradation phenomena such as surface yellowing and the formation of hot spots, which further impair the module's energy conversion efficiency.

Keywords: Photovoltaic modules 1; Glass cracking 2; Dust intrusion 3; Radiative transfer 4.

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7.15 Thermal Performance of Expanded Perlite/PCM21 Composites for Enhanced Building Envelope Inertia

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Abstract: Growing energy consumption in the building sector drives the search for innovative thermal efficiency solutions. This study investigates integrating a low-temperature Phase Change Material (PCM), specifically CrodaTherm21 (PCM21), into walls to boost their thermal inertia. A shape-stabilized composite was developed by dispersing PCM21 within an expanded perlite matrix. Extensive characterization, including FT-IR, DSC, and Hot Disk analysis, evaluated its physicochemical and thermal properties. Results confirm good compatibility and excellent thermal reliability even after 100 cycles. Experimental tests on a prototype wall incorporating this composite, alongside COMSOL numerical simulations, validate MCP21's effectiveness in reducing temperature fluctuations and improving thermal comfort, showing a notable temperature difference between the storage wall's exterior and interior surfaces.

Keywords: Thermal energy storage; Phase change material (PCM21); Thermal properties; Composite; Building.

ICESSE2025-EE-029

7.16 Simulation de l'effet combiné d'un jet et de la rotation d'un disque sur l'écoulement pariétal induit.

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Résumé : L'objectif de ce travail est de faire une étude numérique de l'écoulement pariétal produit par un jet rond venant impacter perpendiculairement un disque en rotation. On utilise le logiciel Ansys Fluent pour le traitement de ce problème. On trace la géométrie de l'installation à l'aide de DesignModeler. Ensuite, on fait un maillage adapté : très fin tout près de la surface du disque pour mettre en évidence l'impact du disque sur l'écoulement, puis grossier ailleurs. Le logiciel offre une gamme complète de modèles de fermeture des équations de Navier-Stokes, tous ayant été testés. Pour notre problème, le modèle à sept équations est le plus approprié. Il présente l'avantage de fournir les composantes du tenseur de Reynolds, pour lesquelles on dispose de valeurs expérimentales. Les résultats sont validés en les comparant à ces valeurs, obtenues par l'expérience dans le cadre d'un travail effectué au laboratoire de mécanique de l'université Flandres Artois de Lille1.

Keywords : *Ecoulement Turbulent ; Pariétal ; Disque tournant ; Simulation numérique.*

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7.17 Numerical analysis of the velocity profile during transient turbulent flow

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Abstract: A semi-analytical expression was developed to simulate the velocity profile as a function of time in a transient turbulent flow. The water hammer equations were solved using the method of characteristics. In the equation of motion, unsteady friction was modelled using the Vardy and Brown model. The small deformation of the pipe and the compressibility of the fluid are taken into account in the speed of sound, which is included in the continuity equation. Firstly, the calculated mean pressures and velocities were compared with experimental data from other papers. Next, the velocity profile modelled by convolution was illustrated by locating certain points in space (situated along the pipe) and in time. Analysis of the shape of the velocity profile obtained shows that, compared with the results of other research, it better reflects the nature of the phenomenon.

Keywords: *Water hammer; Transient flow; Laplace transform; Bessel functions.*

ICESSE2025-EE-031

7.18 Contrôle Actif par Soufflage Continu de l'Ecoulement Turbulent Autour d'un Véhicule Simplifié de Type Corps d'Ahed

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Abstract : Dans un objectif de réduction de la traînée aérodynamique, cette étude expérimentale évalue l'efficacité du contrôle actif de la couche limite par soufflage continu, appliqué à un modèle simplifié de type corps d'Ahed. Cette technique vise à limiter les écoulements décollés en aval du véhicule ou à réduire la section du sillage, principale source de traînée. Les essais ont été réalisés en soufflerie subsonique pour deux vitesses caractéristiques : 60 km/h et 100 km/h. Le contrôle est effectué via douze micro-orifices de soufflage de 600 µm de diamètre, répartis entre la lunette arrière et le culot, afin d'étudier l'effet de leur position, de la pression d'alimentation et de la vitesse d'écoulement amont sur la traînée. Les résultats montrent une amélioration sensible des performances aérodynamiques, avec une réduction de la traînée d'environ 10 % pour un soufflage à 3,5 bar appliqué au niveau de la lunette arrière inclinée de 25 degrés.

Keywords : *Soufflage ; Corps d'Ahed ; Traînée.*

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7.19 Magnetic Control of Heat Transfer in Natural Convection

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Abstract: This study investigates the influence of a constant and inclined magnetic field on natural convection in a square cavity subjected to a horizontal temperature gradient. The fluid considered is molten silicon ($Pr = 0.023$), and the governing equations are solved numerically for a fixed Grashof number ($Gr = 10^6$), various Hartmann numbers (Ha), and different magnetic field orientations in the x - y plane. Results show that increasing the magnetic field intensity leads to a significant reduction in flow velocity due to magnetic damping, and the Nusselt number progressively decreases, approaching unity for high Ha values. This behavior indicates a transition from convection-dominated to conduction-dominated heat transfer. Furthermore, simulations reveal that the orientation of the magnetic field has negligible impact on the global heat transfer efficiency. These findings highlight the magnetic field's potential as a control mechanism for convective transport in thermally driven flows.

Keywords: Natural convection; Nusselt number; Bridgman process; Magnetohydrodynamics.

ICESSE2025-EE-034

7.20 Effect of vertical baffle in liquid sloshing tank

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Abstract: This study examines the impact of a flexible baffle in a partially filled tank subjected to a horizontal motion. To achieve this, a numerical approach is employed to study the fluid structure interaction (FSI) by coupling via preCICE library, two open source codes: fluid solver OpenFOAM based on the Finite Volume Method (FVM) and solid solver FEniCS based on the Finite Element Method (FEM). First this methodology has been validated with experimental results from the literature, and then numerical analyses of sloshing in a rectangular tank with a flexible and rigid baffle has been investigated. The investigation reveals that the height of the baffle substantially mitigates fluid sloshing amplitude.

Keywords: Fluid Structure Interaction (FSI); sloshing; Volume of fluid (VOF); Flexible baffle.

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7.21 Solid-Fluid Flow Modeling and Simulation in Falling Particles-Based Solar Thermal Central Receiver.

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Abstract: Falling particles solar central receiver is a promising innovative technology that uses various particle materials (from 0.1 to 1 mm in size) as a heat transfer media. The free fall design provides the best performance when using a window to vary the mass flow rate, while facilitating visual inspections and minimizing heat loss due to convection. An experimental study, modeling and simulation of a laboratory scale falling particle receiver powered by solar irradiation and integrating a high temperature solid particle thermal energy storage tank. A variable window is used to obtain the desired flow while considering a heat flux density value of 1000 W/m^2 . The preliminary simulation results of the falling particle temperatures with different flow rates of 0.15 kg/s, 0.52 kg/s and 1.06 kg/s. resulted in a non uniform temperature distribution of the particles with a heat transfer coefficient of the receiver approaching $600 \text{ W} \cdot \text{m}^{-2} \cdot \text{K}^{-1}$. The maximum output temperature has reached 411°C .

Keywords: Design; Experimental study; Simulation; Falling particles receiver.

8. Environmental Engineering

ICESSE2025-EE-ME-010

8.1 Development of a composite material: raw earth, sand and olive pomace for use in sustainable construction.

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Abstract: This project exploring the possibility of developing an ecological building material based on raw earth, sand and olive pomace, a by-product of the olive-growing industry that is still little used. The aim is to develop an alternative building material capable of guaranteeing the requirements of standards in mechanical properties terms and good environmental performances, while promoting the integration of local and renewable resources. To achieve this, several formulations were developed in the laboratory with varying percentages of olive pomace (00%, 10%, 20%, and 30%). These were analysed through a series of physical and mechanical tests to characterise their properties and assess their suitability for use in sustainable construction.

Keywords: Raw earth; Sand; Olive Pomace; Mechanical properties.

ICESSE2025-EE-ME-012

8.2 Comparative Albedo-Based Modeling of PERC+ and BiCoRE Bifacial Solar Cells

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Abstract: This study synthesizes findings from two bifacial solar technologies, PERC+ and BiCoRE, to establish a comparative albedo-based model for predicting performance under variable albedo conditions. Using numerical simulations (PC2D for PERC+, PC3D for BiCoRE), we demonstrate robust linear relationships between albedo (A_e) and key parameters: short-circuit current density (J_{sc}), open-circuit voltage (V_{oc}), fill factor (FF), and output power (P_{out}). Results show P_{out} increases linearly with A_e , yielding gains of 72.12% (PERC+) and 66.31% (BiCoRE) on snow ($A_e=0.85$). Derived first-degree equations enable accurate predictions for untested surfaces (e.g., ice, white paint) without simulations. This work validates albedo as a critical lever for optimizing bifacial efficiency in sustainable energy systems.

Keywords: Bifacial solar cells; Albedo; Linear modeling; Performance prediction.

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8.3 Role of Privileged Angles in Wind Flow around Tall Buildings

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Abstract: Researches in many interesting fields of science, nature, medicine, architecture, physics, and mechanics are more interested in the phenomenological analyses and tend to generalize the existence of privileged angles. The criterion of privileged angle was found by Leray et al. (1972) to exist at a macroscopic scale in the case of Helium II supra fluid flow between the helicoids swirls and their axis. In the present work we study four tall buildings exposed to a same wind flow, through the roof sloop values: two building model with a roof inclined with non-privileged (NP) angles $\alpha = 25^\circ$ and 33° , and a model with a roof inclined with a privileged (P) angle $\alpha = 30^\circ$ and finally a classical building model with flat roof $\alpha = 0^\circ$ the models height is H. Pressure and drag measurements were carried out at normal and inclined wind flow then important results were obtained.

Keywords: privileged angles; Bluff-body aerodynamics; wind force; wind pressure distribution; building roof shape.

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8.4 Optimization of Battery Storage for a Grid-Connected PV System

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Abstract: This work proposes a management model for the electrical energy produced by a photovoltaic (PV) installation integrating battery storage. The system is designed to supply a research laboratory with electricity throughout the year. The PV system is coupled to the conventional power grid, which intervenes as a last resort when the energy provided by the PV panels and batteries is insufficient. The management model incorporates an hourly optimization strategy that promotes self-consumption and protects the batteries. Analysis of the quantities of electrical energy consumed with regard to battery capacities ranging from 1 to 12.5 kWh shows that, with a capacity of only 4 kWh, the PV system alone can cover 91.36% of the laboratory's needs throughout the year.

Keywords: Battery; Electrical energy; Optimization; Photovoltaic.

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8.5 Comparison of the Properties of Mono-like, Monocrystalline, and Multicrystalline Silicon for Photovoltaic Applications.

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Abstract: This study investigates quasi-mono silicon (ML-Si) as a promising alternative to conventional crystalline silicon materials for photovoltaic applications. Produced by directional solidification with seeded growth, ML-Si combines the low-cost advantage of multicrystalline silicon (mc-Si) with the superior crystal quality of monocrystalline silicon (Cz-Si). Morphological analysis using SEM reveals that ML-Si exhibits surface features and uniform pyramidal structures similar to Cz-Si, while mc-Si shows irregular textures. XRD confirms that both ML-Si and Cz-Si share the (100) crystallographic orientation, whereas mc-Si displays multiple orientations. EDX analysis indicates high purity of ML-Si, with silicon as the dominant element and only trace impurities detected. Optical measurements demonstrate that, after alkaline texturing, ML-Si maintains a reflectivity about 5% higher than Cz-Si but significantly lower than mc-Si, reflecting enhanced light-trapping properties. With its reduced dislocation density, structural uniformity, and competitive optical performance, ML-Si emerges as a cost-effective material capable of delivering efficiencies close to Cz-Si. These findings underline the strong potential of ML-Si to support sustainable, high-efficiency, and economically viable solar cell manufacturing.

Keywords: Quasi-mono silicon (ML-Si); Crystal quality; Texturing; Photovoltaic applications.

ICESSE2025-EE-ME-020

8.6 Olive biomass gasification-based power generation in the Tizi Ouzou region.

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Abstract: This study presents a theoretical modelling and simulation of a small-scale CHP system utilizing olive, a high-calorific-value biomass abundantly available in the Tizi Ouzou. The plant consists of a downdraft gasifier, an externally fired gas turbine (EFGT), and an Organic Rankine Cycle (ORC) as the bottoming unit. The syngas generated from the gasification process exhibits the following composition: CO (20%), H₂ (16%), CO₂ (11.98%), CH₄ (2.98%), and N₂ (48%), with a lower heating value (LHV) of 4.5 MJ/kg and a gasification efficiency of 73%. To optimize the electricity production, five ORC fluids; cyclohexane, R113, R245fa, benzene, and isopentane are evaluated. Isopentane demonstrates the best thermodynamic performance, yielding a power output of 35.4 kWe. This increases the total electrical output from 75.8 kWe to 111.2 kWe and improves the overall efficiency from 16.41% to 23.48%. An economic analysis is also conducted, assessing the project's viability. The results indicate promising economic feasibility, largely attributed to the low cost and local availability of the biomass.

Keywords: Olive tree pruning; Gasification; Biomass; Power generation.

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8.7 Numerical simulation of the flow around bodies with different slits

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Abstract: The flow around a body with slits has been investigated numerically. The main purpose of this study is to show the effect of the slits on the vortex detachment behind a smooth shape, and stationary using the finite element approach to solve the fluid governing equations system at Re = 200. The variation of the spacing ratio (D/S) of the slit is strongly influenced both the various physical parameters and the vortex detachment behind a different body. We found that the drag coefficient varies because the different geometric and different slits. We also found that the values of the Strouhal number vary between 0.152 and 0.27 according to the spacing ratio (D/S) of the slit.

Keywords: Vortex detachment; Drag force; Turbulence; Slit.

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8.8 Exploring the variability of keratin composition for the design of sustainable acoustic insulators and humidity regulators.

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Abstract: In response to energy and environmental challenges, the development of sustainable and eco-friendly acoustic insulation materials has become a priority. Materials derived from renewable resources, such as biopolymers, offer a promising alternative due to their biocompatibility and low environmental impact. This study explores the use of keratin for applications in acoustic insulation and humidity regulation within the building sector. The morphological, structural, mechanical (tensile test), and hygroscopic (humidity test) properties of the keratin film were evaluated using appropriate analytical techniques. The results reveal a fibrous, porous, and slightly rough structure, favorable for sound absorption and moisture retention. The material's porosity notably enhances its adsorption capacity, reinforcing its potential as a thermal and acoustic insulator. These findings highlight the potential of keratin as a multifunctional bio-based material for sustainable construction applications.

Keywords: Keratin; Humidity sensor; Acoustic material; Humidity regulation.

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8.9 Surface Chemical Engineering for High-Efficiency Photovoltaic Cells: Mechanisms and Advances

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Abstract: Surface chemical treatments are pivotal in overcoming efficiency limits in photovoltaic (PV) technologies by controlling interfacial properties at micro- and nanoscales. This systematic study analyzes how surface chemistry governs three critical performance parameters in PV cells: (1) light management, (2) charge carrier dynamics, and (3) electrical contact properties. **Light Absorption Enhancement:** Chemical texturing (Si in KOH/NaOH) reduces surface reflectance to <5% via pyramidal or porous structures, while wet-chemical deposition of anti-reflective coatings further broadens spectral response. **Defect Passivation:** Surface treatments with atomic hydrogen or thin-film dielectrics neutralize dangling bonds, suppressing Shockley-Read-Hall recombination. Advanced passivation schemes (e.g., field-effect passivation in PERC cells) enable Voc gains of 10–30 mV. **Contact Optimization:** Pre-metallization cleaning (HF/HCl solutions) and selective doping (e.g., BSF formation) reduce contact resistance (Rc) by up to 50%, improving fill factors to >82%.

Keywords: Solar cell; Chemical treatments; Porous structures; Pyramidal texturing.

ICESSE2025-EE-CE-001

8.10 Towards Circular and Economical WWTPs in Algeria: a model for optimising operational performance

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Abstract: Population growth, climate change and economic growth have led to major changes in the consumption of natural resources, which make the implementation of reduction, reuse and recovery strategies essential. This study provides an assessment framework aimed to optimise the functioning of wastewater treatment plants (WWTPs) in order to promote their transition towards a Circular Economy (CE) model. The methodology adopted is based on a top-down participative approach, structuring the assessment from the priority objective defined to the performance criteria and indicators. The main objective is to optimise the operation of the WWTPs, around which six evaluation criteria are structured. This approach allows to identify concrete levers for the optimisation of WWTPs and to accompany the stakeholders in the progressive transition towards EC WWTPs adapted to the environmental challenges and to the specificities of the Algerian context.

Keywords: Assessment; Circular economy; Performance optimising; WasteWater Treatment Plant.

ICESSE2025-EE-CE-002

8.11 Decision Support Tool for Financial Management of Sanitation Services in Algeria

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Abstract: Urban water management has become a major concern, particularly in Algeria. Managed by the National Sanitation Office (ONA), managers are often faced with technical challenges, lack of material resources and financial constraints. The aim of this study is to propose a decision-support tool to assist ONA in assessing the financial management of its service. This tool is based on a participatory multi-criteria approach involving a team from the Applied Hydraulics and Environment Research Laboratory at the university of Bejaia and ONA managers. The adopted approach integrates the concept of performance through the definition of elements (objectives, criteria and indicators). These elements are identified and defined taking into account the local context, management priorities and available data. The project focuses on improving financial management and optimizing operational costs. The proposed model will be tested on the ONA unit in the town of Bejaia.

Keywords: Urban water; Evaluation; Financial management; Performance.

ICESSE2025-EE-CE-003

8.12 Sustainable Material Management for Earth Dams: An Integrated Geotechnical and Environmental Approach

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Abstract: The sustainability of earth dams relies on the rational exploitation of borrow materials that are both geotechnically efficient and environmentally responsible. This study proposes an integrated approach for the selection, characterization, and optimized allocation of materials in a sustainable construction context, illustrated through the Souk Tleta zoned earth dam project (Algeria). Five borrow areas near the site were identified and evaluated through classification tests (USCS, Atterberg), compaction tests (Proctor), and mechanical behavior tests (oedometer, triaxial, permeability). Each material was assigned to a specific functional zone of the structure based on its performance characteristics (core, filter, shell, rockfill). A simplified environmental assessment was integrated, estimating the carbon footprint related to transport distances and required treatments. The results demonstrate that strategic selection of local deposits enables the reconciliation of technical requirements, environmental impact reduction, and cost control within a sustainable civil engineering framework.

Keywords: Local materials; Sustainable materials; Earth dam; Geotechnical durability; Environmental assessment

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8.13 Éléments vers une réconciliation avec l'environnement. Habiter est notre condition

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Abstract : Habiter n'est pas seulement résider, il est la relation que les hommes entretiennent avec le monde. Il se traduit par beaucoup d'actes, de processus et d'objets différents impliquant l'ensemble des activités humaines (travail, résidence, loisirs, etc.), où l'habitant devient ainsi un acteur territorial à part entière. L'environnement transformé, structuré, organisé et embelli devient un lieu spécifique, culturel par l'empreinte de l'homme. Néanmoins, cette dernière peut aussi le déconstruire quand le bâtir s'avère inapproprié. L'habiter objet multiscalaire concerne à la fois l'espace privé, l'habitat, le logement ainsi que les espaces partagés tels que le territoire, le paysage, et l'écosystème (l'environnement). En effet, notre questionnement se focalise sur la question de l'habiter et du bâtir en relation avec l'architecture qui se doit d'être conjuguée avec son environnement. Par conséquent l'*habiter* à proprement parler peut se manifester de manière prépondérante ou dissimulée, en renforçant un site ou au contraire briser son équilibre.

Keywords : Architecture ; Cultures constructives ; Environnement ; Habiter.

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8.14 Towards Outdoor Spaces Adapted to Ageing: Combined Effects of Climate and the Built Environment

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Abstract: In the context of climate change, outdoor spaces are becoming increasingly hostile for older adults due to high temperatures and the lack of appropriate design strategies. This study investigates the effect of spatial configuration and microclimatic factors on the health of elderly individuals during walking routes in a traditional Algerian village. The results show that a high Sky View Factor and a low Height-to-Width ratio significantly increase forehead skin temperature, stress level, and thermal sensation, while reducing walking speed ($P \leq 0.001$). Conversely, high visibility of vegetation and buildings, combined with a low mean thermal radiant temperature, promotes better thermal perception and a more relaxed state ($P \leq 0.001$). The study highlights the importance of spatial configuration characteristics in adapting walking spaces to the needs of older adults during heatwaves.

Keywords: Climate change; Spatial configuration; Older adults; Design strategies.

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8.15 Child-Centered Strategies for Urban Heat Island Mitigation: A Literature Review on Sustainable Design for Thermal Comfort

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Abstract: Urban Heat Islands (UHIs) pose increasing challenges to urban health and livability, disproportionately affecting vulnerable populations such as children. Due to their limited thermoregulatory capacity and greater exposure to outdoor environments, children are especially susceptible to heat-related illnesses in urban settings. This literature review explores sustainable urban design strategies that mitigate UHI effects while enhancing thermal comfort for children in public spaces. By examining peer-reviewed studies, technical reports, and real-world cases, the review identifies key interventions such as green infrastructure, high-albedo materials, and spatial design for improved ventilation. It further highlights the importance of integrating children's needs and perspectives in the planning process to ensure more inclusive and thermally resilient environments. Ultimately, the findings emphasize that child-centered design is not only essential for safeguarding health and well-being but also a strategic component of sustainable urban development, especially in climate-vulnerable regions.

Keywords: Urban Heat Islands; Children; Thermal Comfort; Climate-Responsive Planning.

ICESSE2025-EE-CE-008

8.16 Assessing Material Properties and Reuse Viability of Industrial Sludge in a Gas Complex

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Abstract: Water treatment plants (WTPs) produce a by-product known as water treatment sludge (WTS) during the purification of raw water. This sludge is primarily composed of silica (SiO₂), alumina (Al₂O₃), ferric oxide (Fe₂O₃), and lime (CaO), along with trace amounts of heavy metals. Due to the presence of thermally stable refractory metals, which exhibit low volatility at elevated temperatures (200 °C and 400 °C), the sludge residues become enriched following thermal treatment. To better understand the mineralogical composition and physico-chemical and microstructural characteristics of WTS, a comprehensive analysis was conducted. Characterization techniques included proximate and ultimate analysis, field emission X-ray fluorescence (XRF), scanning electron microscopy (SEM), attenuated total Reflectance-Fourier transform infrared spectroscopy (ATR-FTIR), and X-ray diffraction (XRD). These methods provided valuable insights into the elemental composition, crystalline structure, surface morphology, and functional groups present in the sludge, contributing to potential strategies for its reuse and environmental management.

Keywords: Water; WTPs; Sludge; Treatment.

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8.17 Defense in depth concept and environmental impact study of a nuclear installation

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Abstract: One of the fundamental concepts of nuclear safety philosophy is defense in depth. The objective of this approach is twofold: first, to prevent accidents, and second, to limit the potential consequences and prevent them from escalating into serious situations with unacceptable consequences, should such prevention fail and an accident occur. One aspect of nuclear safety is the prevention of accidents. In this article, we present a method for assessing the radiological risk of a hypothetical accident to prepare the emergency plan, which is one of the fundamental criteria of nuclear safety. The method for determining the radiological effects outside a nuclear reactor due to a radioactive release accident is presented here in a simplified manner. To calculate the radiological consequences, we assume partial core damage due to a loss of coolant.

Keywords: Nuclear Safety; Emergency Plan; Radiological Impact; Atmospheric Dispersion.

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8.18 The Efficiency of Stiffeners on the Performance of Thin Square Clamped Plates under Concentrated Loading

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Abstract: This study investigates the influence of stiffeners and their positioning on the bending behavior of thin stainless-steel plates. Three experimental models were employed: a simple un-stiffened plate, a plate with one stiffener and a plate with two cross stiffeners with clamped boundary conditions. Numerical analysis with ABAQUS software and the C3D8IH solid finite element is carried out and the obtained results are compared to those found experimentally. The findings reveal that the introduction of stiffeners significantly enhances the structural rigidity of the plates, leading to reduced deflection under applied loads. Very good efficiency was observed where the accuracy of the numerical model improved with increasing load, particularly for the cross-stiffened configuration. The error rates between the numerical and experimental results decreased from 19.93% at lower loads to as low as 0.1675% at higher loads, underscoring the effectiveness of stiffeners in minimizing deflection and aligning theoretical predictions with the experimental outcomes. This research provides valuable insights into the design of stiffened plates for applications requiring enhanced loadbearing capacity and reduced deformations.

Keywords: *Experimental test; Numerical analysis; Stiffened Square plate; 3D finite element; Reduced deflection*

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8.19 INSUL software use for predictive assessment of acoustic insulation in partition walls against airborne noise: Towards improved building acoustics in Algeria

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Abstract: Controlling noise transmission in buildings is a key factor for ensuring health, comfort, and regulatory compliance. In Algeria, however, acoustic insulation remains an overlooked aspect in the construction process, particularly for partition walls and floors. This study investigates the acoustic performance of typical partition configurations using INSUL software, an internationally recognized sound insulation prediction tool. The objective of this study is to assess the airborne sound reduction index (Rw, dB) of typical Algerian partition wall configurations using INSUL software, in order to evaluate their insulation performance against international standards. Results demonstrate the significant influence of wall thickness, cavity design, and insulation materials on airborne noise reduction. The findings provide practical insights for architects and engineers to enhance acoustic design from early project stages.

Keywords: *INSUL; Acoustic comfort; Partition walls; Building acoustics; Algeria;*

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8.20 Numerical Study of the Mechanical Behavior of Functionally Graded Beams under Bending

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Abstract: Faced with environmental constraints and the demand for sustainable, high-performance structures, traditional materials are increasingly inadequate. This has led researchers to explore innovative alternatives such as functionally graded materials (FGMs), which offer a continuous variation of mechanical properties across the structure according to a predefined law, linked to microstructure and composition. This study aims to model and numerically simulate the shear and bending behaviour of FGM beams under uniformly distributed loading. The analysis is conducted using ABAQUS, based on the finite element method. The main objective is to evaluate the influence of material gradation and the non-dimensional span-to-depth ratio on deflection and stress distribution. Numerical results are compared with analytical solutions, showing a good agreement and validating the proposed model.

Keywords: FGM beam; Flexural behavior; Numerical modeling; Power-law function.

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8.21 Evaluating Raw Kaolin Clay as a Partial Substitute for Portland Cement in mortar

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Abstract: This study evaluates the mechanical performance of mortar incorporating raw kaolin clay at 10%, 20%, and 30% replacement levels by cement weight, compared against metakaolin data from literature. Compressive and flexural strength tests were performed at 7, 28, and 90 days. Results indicate limited pozzolanic activity for raw kaolin, with optimal performance at 10% replacement, yielding compressive strengths near control specimens. Higher levels (20-30%) show strength declines due to cement dilution outweighing pozzolanic benefits. Raw kaolin offers energy and cost savings over metakaolin, supporting sustainable construction.

Keywords: Kaolin clay; Portland cement; supplementary cementitious materials; Mortar performance.

