ATHENS INSTITUTE

Abstract Book

14th Annual International Conference on Industrial, Systems and Design Engineering
22-26 June 2026, Athens, Greece

Edited by
Theodore Trafalis & Olga Gkounta

2026

Abstracts
14th Annual International Conference on Industrial, Systems and Design Engineering

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TABLE OF CONTENTS

(In Alphabetical Order by Author's Family Name)

Preface

This book includes the abstracts of all the papers presented at the *14th Annual International Conference on Industrial, Systems and Design Engineering* (22-26 June 2026), organized by the Athens Institute.

A full conference program can be found before the relevant abstracts. In accordance with Athens Institute's Publication Policy, the papers presented during this conference will be considered for inclusion in one of the Athens Institute's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of the Athens Institute and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. Athens Institute was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a references section includes all the abstract books published as part of this conference (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to the Athens Institute's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

Table 1. *Publication of Books of Abstracts of Proceedings, 2013-2026*

Year	Papers	Countries	References
2026	23	17	Trafalis and Gkounta (2026)
2025	21	15	Trafalis and Papanikou (2025)
2024	27	14	Trafalis and Gkounta (2024)
2023	28	19	Trafalis and Gkounta (2023)
2022	26	15	Trafalis and Gkounta (2022)
2021	12	5	Papanikos (2021)
2020	15	9	Papanikos (2020)
2019	20	13	Papanikos (2019)
2018	29	19	Papanikos (2018)
2017	29	15	Papanikos (2017)
2016	47	21	Papanikos (2016)
2015	46	25	Papanikos (2015)
2014	33	11	Papanikos (2014)
2013	20	14	Papanikos (2013)

It is our hope that through Athens Institute's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, Athens Institute has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 7 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of the Athens Institute for putting this conference and its subsequent publications together.

Gregory T. Papanikos
President

Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Industrial, Systems and Design Engineering. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the conference.

Athens Institute's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The *14th Annual International Conference on Industrial, Systems and Design Engineering*, accomplished this goal by bringing together academics and scholars from 17 different countries (Brazil, Canada, China, France, Germany, India, Israel, Italy, Mexico, Portugal, Serbia, South Africa, South Korea, Spain, Türkiye, UK and the USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this conference will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

Theodore Trafalis & Olga Gkounta
Editors

14th Annual International Conference on Industrial, Systems and Design Engineering, 22-26 June 2026, Athens, Greece

Organizing & Scientific Committee

All Athens Institute's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of Athens Institute.

Dr. Gregory T. Papanikos, President, Athens Institute & Professor (Adjunct), University of Tennessee, Knoxville, USA.

Dr. Theodore Trafalis, Head, Industrial Engineering Unit, ATINER & Professor of Industrial & Systems Engineering and Director, Optimization & Intelligent Systems Laboratory, The University of Oklahoma, USA.

Dr. Timothy M. Young, Director, Center for Data Science (CDS), Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

Dr. Virginia Sisiopiku, Head, Transportation Engineering Unit, ATINER & Professor, The University of Alabama at Birmingham, USA.

Dr. Nicholas N. Patricios, Vice President of Strategic Planning & Analysis, ATINER, Dean Emeritus & Professor, School of Architecture, University of Miami, USA.

Dr. Nikos Mourtos, Head, Mechanical Engineering Unit, ATINER & Professor, San Jose State University USA.

Dr. Bala Maheswaran, Director, Engineering Division, ATINER & Professor, Northeastern University, USA.

Dr. Dimitrios Goulias, Head, Civil Engineering Unit, ATINER & Associate Professor, Civil & Environmental Engineering Department, University of Maryland, USA.

FINAL CONFERENCE PROGRAM
14th Annual International Conference on Industrial, Systems and Design Engineering, 22-26 June 2026, Athens, Greece

PROGRAM

Monday 22 June 2026

08:30-09:15
Registration
09:15-10:00 Opening Speech and Welcoming Remarks
Speaker: Timothy M. Young, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

10:00-11:30 Session 1
Moderator: Virginia Sisiopiku, Head, Transportation Engineering Unit, Athens Institute, & Professor, The University of Alabama at Birmingham, USA.

1. **Lorenzo Mussone**, Professor, Politecnico di Milano, Italy.
   ***Title**: Black Spot Identification of Road Crashes on Highways.*
2. **Sundaravalli Narayanaswami**, Associate Professor, Indian Institute of Management Ahmedabad, India.
   ***Title**: Role of Ports in PM Gati Shakti Mission: An Innovative National Transportation Policy of India.*
3. **Ndakhona Bashingi**, Lecturer, Cape Peninsula University of Technology, South Africa.
   ***Title**: Barriers to Walkability: Non-Motorized Transportation as a Sustainable Mobility Solution in Worcester, Western Cape.*
4. **Fadi Shahin**, Lecturer, Braude College of Engineering, Israel.
   Wafa Elias, Professor, Sami Shamoon College of Engineering, Israel.
   ***Title**: Risk Perception and Barriers to Electric Scooter Prevalence.*

11:30-13:00 Session 2
Moderator: Theodore Trafalis, Head, Industrial Engineering Unit, Athens Institute, Professor of Industrial & Systems Engineering and Director, Optimization & Intelligent Systems Laboratory, The University of Oklahoma, USA.

1. **Rainer Lehmann**, Professor, Technical University of Applied Sciences Lübeck, Germany.
   ***Title**: Warehouses in the Supply Chain Digital, Efficient and Sustainable.*
2. **Akbar Eslami**, Professor, Elizabeth City State University, USA.
   Title: Conceptual Design, Analysis, and Prototype Design of a VTOL Drone.
3. **Christian Donhauser**, Director, Institute for Efficient Production Technology, Kempten University of Applied Sciences, Germany.
   ***Title**: Inline Process Optimization for Swivel Bending with Self-Adaptive Control.*

13:00-14:30 Session 3
Moderator: Dimitrios Goulias, Head, Civil Engineering Unit, Athens Institute and Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.

1. **Glen Bright**, Dean of Engineering, University of KwaZulu-Natal, South Africa.
   ***Title**: Agricultural Potential of a Low-Cost, Intelligent Industrial UAV Seed Sowing System.*
2. **Rui Costa Neto**, Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Antonio Rolo Bual, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   ***Title**: Assessment of the Potential Consumption of Green Hydrogen in the Portuguese Industrial Sector as a Direct Feedstock and for High Heat Applications.*
3. **Pavel Ikonomov**, Professor, Western Michigan University, USA.
   Siddi Govardhan Reddy Karapureddy, PhD Student, Western Michigan University,

USA.
***Title**: Vision-based AI/ML-Enabled Optimization for Hybrid Metal 3D Printing.*

14:30-15:30 Lunch

15:30-17:00 Session 4 – A Symposium on "The *Future of Science: Education, Research, and Innovation*"
Moderator: Timothy M. Young, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

1. **Caroline Barakat**, Professor, Ontario Tech University, Canada.
   ***Title:** Reimagining Science for a Rapidly Changing World: Research, Education, and Innovation in an Era of Global Transformation and Human Challenges.*
2. **Cristiane Bernardo**, Associate Professor, São Paulo State University (UNESP), Brazil.
   ***Title:** Scientific Dissemination in Master's and Doctoral Programmes: Practices, Challenges and Impacts. A Case Study of the Graduate Program in Agribusiness and Development.*
3. **Seher Nur Sulku, Professor,** Ankara Haci Bayram Veli University, Türkiye.
   ***Title:** AI in Health: Rethinking Education, Research, and Innovation.*
4. **Dimitrios Goulias,** Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.
   ***Title:** Multidisciplinary Transformative Aspects in Engineering Research & Education.*
5. **Virginia Sisiopiku**, Professor, The University of Alabama at Birmingham, USA.
   ***Title**: The Changing Landscape of Science & Engineering: Opportunities and Challenges.*
6. **Sundaravalli Narayanaswami**, Associate Professor, Indian Institute of Management Ahmedabad, India.
   ***Title:** Responsible AI: Trade-offs and Prospects for a Better Society.*

Interventions:

1. **Rainer Lehmann**, Professor, Technical University of Applied Sciences Lübeck, Germany.
2. **Ndakhona Bashingi**, Lecturer, Cape Peninsula University of Technology, South Africa.

18:00-20:00 Session 5 – Visit Aristotle's Lyceum

This is not a guided tour, and participation in this visit is **not included in any conference registration fee**. **It requires pre-booking.** It includes visits to Aristotle's Lyceum, the Panathenaic Stadium (Kallimarmaro), the National Garden, the statues of Sophocles, Aeschylus, and Euripides, and Syntagma Square, where the tour concludes in front of the Hellenic Parliament. Click here for more details.

20:30-22:30 Athenian Early Evening Symposium (Sequence of Events: Ongoing Academic Discussions, Dinner, Wine and Water, Music, Dance)

Tuesday 23 June 2026

09:00-10:30 Session 6
Moderator: Rainer Lehmann, Professor, Technical University of Applied Sciences Lübeck, Germany.

1. **Adnan Enshassi**, Professor, Technische Universität Berlin, Germany.
   Matthias Sundermeier, Professor, Technische Universität Berlin, Germany.
   ***Title**: Strategies for Overcoming Barriers to Circular Economy Adoption in Gaza's Post War Demolition Waste.*
2. **Md Asaduzzaman**, Associate Professor, University of Staffordshire, UK.
   ***Title**: Optimal Design of a Cantilever I-Beam: A Response Surface Approach Using ANSYS Software.*
3. **Christian Karl**, Associate Professor, University of Duisburg-Essen, Germany.
   ***Title**: Human-Centered Resilience and Climate Risk Mitigation: A Systemic Learning Approach for Civil and Environmental Engineering.*

4. **Sofia Margarita Vidalis**, Associate Professor, Penn State Harrisburg, USA.
   ***Title**: Smarter Homes for Aging in Place: From Insight to Immersive Design.*

10:30-12:30 Session 7
Moderator: Sundaravalli Narayanaswami, Associate Professor, Indian Institute of Management Ahmedabad, India.

1. **Jun-Qing Lei**, Professor, Beijing Jiaotong University, China.
   ***Title**: Research of Reinforced Concrete Bridge Fire Prevention and Disaster Reduction Mechanism.*
2. **Tae Myung Shin**, Emeritus Professor, Korea National University of Transportation, South Korea.
   ***Title**: Performance Review of Cabinets in Nuclear Plants by Application of Small Seismic Bearings.*
3. **Hui Ying Wang**, Professor, Pprime Institute – CNRS, France.
   ***Title**: Large Eddy Simulation of Fire Suppression via Water Mist Using FDS and Firefoam.*
4. **Roberto Gomez**, Associate Professor, National Autonomous University of Mexico, Mexico.
   ***Title**: Monitoring the Construction of an Arch Bridge.*
5. **Yunus Gunduz**, Assistant Professor, Yozgat Bozok University, Türkiye.
   Abdulrezzak Alkan, Master's Student, Yozgat Bozok University, Türkiye.
   Yuşa Şahin, Associate Professor, Yozgat Bozok University, Türkiye.
   ***Title**: The Effect of Hemp Fibers on the Mechanical Properties of Cementitious Mortars.*

12:30-14:00 Session 8
Moderator: Christian Donhauser, Director, Institute for Efficient Production Technology, Kempten University of Applied Sciences, Germany.

1. **Aleksandar Jovanovic**, Assistant Professor, Autonomous University of Barcelona, Spain.
   Nikola Barac, Master's Student, University of Belgrade, Serbia.
   ***Title**: Signal Timing Optimization for Quadrant Roadway Intersections Using Max-Pressure Algorithm.*
2. **Mariana Franco**, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Wagd Ajeeb, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Eliane Cassoma, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Rui Costa Neto, Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   ***Title**: Production of Electrolytic Hydrogen and Sustainable Ammonia for Shipping Decarbonization, Based on the Portuguese Grid Mix.*
3. **Mali Sher**, Lecturer, Holon Institute of Technology, Israel.
   Nina Garmash, Researcher, Holon Institute of Technology, Israel.
   ***Title**: Beyond Crash Counts: Integrating Volume, Severity, and Exposure for Micromobility Safety.*
4. **Eliane Cassoma**, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Mariana Franco, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Wagd Ajeeb, Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   Rui Costa Neto, Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal.
   ***Title:** Evaluating Synthetic Aviation Fuel for Transport Decarbonisation: Techno-Economic and LCA Insights from the Portuguese Power System.*

14:00-15:00 Lunch

15:40-19:30 Session 9
Old and New-An Educational Urban Walk

The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by the Athens Institute exclusively for the conference participants.

20:30-22:30
Ancient Athenian Dinner

Wednesday 24 June 2026
An Educational Visit to Selected Islands
or Nafplio & Mycenae Visit

Thursday 25 June 2026
Visiting the Oracle of Delphi

Friday 26 June 2026
Visiting the Ancient Corinth and Cape Sounion

Md Asaduzzaman
Associate Professor, University of Staffordshire, UK

Optimal Design of a Cantilever I-Beam: A Response Surface Approach Using ANSYS Software

Optimisation plays a central role in modern engineering design and analysis. This paper presents a student-oriented example of multi-objective structural optimisation---the optimal design of a cantilever I-beam---to demonstrate how theoretical optimisation concepts can be combined with computational simulation. The study first introduces the fundamentals of optimisation theory, including objective functions, constraints, and types of optimisation problems. Analytical and simulation-based approaches are briefly discussed. Subsequently, a response surface methodology (RSM) framework implemented in ANSYS Workbench is described to solve the problem of minimising simultaneously both the mass and the deflection of a cantilever I-beam. The approach integrates finite element analysis (FEA), design of experiments (DOE), and multi-objective optimisation to produce a Pareto front. This integrated workflow enhances engineering students' understanding of optimisation principles through hands-on simulation-based learning.

Ndakhona Bashingi
Lecturer, Cape Peninsula University of Technology, South Africa

Barriers to Walkability: Non-Motorized Transportation as a Sustainable Mobility Solution in Worcester, Western Cape

Non-Motorised Transportation (NMT) modes are a solution to many transportation problems caused by motorised transportation and are a key indicator of efforts towards sustainable transportation. Global and national development strategies towards sustainability call for promotion of NMT to improve sustainability. In cities where land uses, transportation infrastructure caters to fast-paced socio-economic activity, walking is not prioritised as a mode of travel hence the need to firstly explore barriers and factors that hinder the uptake of walking and use of other NMT modes as regular means of travel.

This study assesses constraints and identifies some barriers to NMT use, focusing mostly on walking and cycling behaviours and infrastructure in the Western Cape town of Worcester. The paper employs both quantitative and qualitative methods; Quantitative data obtained through infrastructure assessments and questionnaire surveys and qualitative data obtained from residents of Worcester through open ended questionnaires. Travel behaviours of respondents, their regular attractions and activities that create non-motorised trips as well as their walking and cycling experiences are presented. The study also employs physical assessments of NMT supporting infrastructure to identify physical properties of infrastructure, develop relationships between walking and infrastructure. Relative Importance and Walkability Indices in the context of a South African farming town are drawn. Cross tabulation is used to establish relationships between factors likely to influence the use or lack thereof of non-motorised transportation modes to analyse the relationship between infrastructure, land-use and patterns of NMT use.

The study is significant as it contextualises infrastructural, engineering, land-use planning and social factors relating to Non-Motorised Transportation in Worcester.

Glen Bright
Dean of Engineering, University of KwaZulu-Natal, South Africa

Agricultural Potential of a Low-Cost, Intelligent Industrial UAV Seed Sowing System

This study, researched and develop a low-cost, intelligent industrial UAV seed planting system, with sensor technology to support agricultural practices. Current methods of direct seeding are limited in terms of cost, scalability and are labour intensive. The mechanical structure of the UAV's seed sowing system was modularly designed, to fit onto a commercial drone and is pneumatically actuated for accurate and repeatable seedpod embedding. The microcontroller architecture targeted autonomous seed delivery, metering, pressure regulation and synchronicity with a remote operator. Real-time depth-adjustment and operator feedback over large-scaled isolated plots were enabled through LoRa telemetry. Critical safety features including identification of pneumatic faults and EEPROM-based data retention ensured continuous flight operation and improved system reliability. Ballistic simulations performed in Matlab allowed for optimization of key system parameters, which was used for selection of barrel length and system pressure rating. An ANSYS stress simulation was conducted to manufacture a plenum chamber. The component enabled the variation of planting depths, through pressurization of the system in an operating range up to 5 MPa. Experimental testing of the manufactured UAV's seed sowing system confirmed the dependence of seedpod terminal depth with muzzle velocity and soil hardness.

The results of the ballistics tests validated the performance of the system in terms of pressure regulation stability and repeatable seedpod embedding. An average terminal depth of up to 4 cm occurred in loose soil conditions at field capacity, despite varying soil structures. A custom class YOLOv5 model was trained to detect seedpods, for post-plant pitch evaluation and computation of ISO equipment performance indicators. The trained model achieved an accuracy of 94% (mAP@0.5) and provided a reliable foundation for use as dynamic feedback for real-time adjustment of seeding equipment. The integrated system is suitable for scalable aerial seeding platforms but cannot be fully adapted into the precision agriculture sector in isolation. The system should be used in combination with existing strategic methods for irrigation and soil maintenance. Future work could include PID adaption for improved

pressure regulation and extended field trials to validate and optimize system autonomy and performance considering UAV flight dynamics.

Eliane Cassoma
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
Mariana Franco
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
Wagd Ajeeb
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
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Rui Costa Neto
Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal

Evaluating Synthetic Aviation Fuel for Transport Decarbonisation: Techno-Economic and LCA Insights from the Portuguese Power System

Long-haul aviation is widely recognized as one of the most challenging transport sectors to decarbonize, as it will continue to rely on energy-dense liquid fuels well beyond 2030. Synthetic aviation fuels (SAF) produced via power-to-liquid (PtL) pathways from renewable electricity, hydrogen, and captured CO_2 have emerged as a promising option to reduce life-cycle greenhouse gas (GHG) emissions while remaining compatible with existing aircraft and fuel infrastructure. However, current cost estimates for SAF remain several times higher than those for fossil jet fuel, and life-cycle impacts are highly sensitive to the carbon intensity and price of the electricity used in production. This is particularly relevant in high renewable electricity systems such as Portugal, where hydro, wind, and solar already account for a large share of generation, but where the residual mix still contains fossil-based capacity.

This study presents a combined techno-economic assessment (TEA) and life-cycle assessment (LCA) of a SAF PtL plant integrated with the Portuguese electricity system. The process configuration comprises water electrolysis, direct air CO_2 capture (DAC), either solid (S-DAC) or liquid (L-DAC), and Fischer-Tropsch synthesis with downstream upgrading to SAF and co-products. The TEA estimates the levelized cost of fuel (LCOF), accounting for capital and operating costs of the main process units and electricity prices under a representative Portuguese grid mix. The LCA quantifies Well-to-Wake (WtWa) GHG emissions, using the average Portuguese grid mix as the energy supply for

electricity-driven processes and comparing with onsite-generated renewable electricity supply. The analysis explores how variations in electricity prices, grid carbon intensity, and selected technological parameters affect both costs and emissions.

The economic assessment estimates an LCOF of 3.23 €/kg and 3.50 €/kg for S-DAC and L-DAC, respectively. The LCA reveals that the WtWa global warming potential (GWP) is 26.65 gCO_2eq/MJ for S-DAC with grid electricity, decreasing to 19.92 gCO_2eq/MJ when utilizing onsite-generated renewable electricity. In the L-DAC scenarios, the GWP amounts to 52.62 gCO_2eq/MJ with natural gas and 14.79 gCO_2eq/MJ when powered by onsite solar energy. These findings indicate that, under current Portuguese electricity prices and grid carbon intensity, SAF production remains significantly more expensive than fossil jet fuel but offers considerable GHG reductions when low-carbon electricity is used. The analysis highlights the dominant contributions of electricity costs and electricity-related emissions to both LCOF and climate impact, and illustrates how key parameters, such as DAC different configurations and electricity prices, influence SAF competitiveness. This research provides insights for transport engineering decision-makers by quantifying the trade-offs between costs and emissions associated with integrating PtL-based SAF production into high-renewable electricity systems.

Rui Costa Neto
Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
&
Antonio Rolo Bual
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal

Assessment of the Potential Consumption of Green Hydrogen in the Portuguese Industrial Sector as a Direct Feedstock and for High Heat Applications

The global need to decarbonize energy systems has intensified the search for alternative production, storage, and transport solutions. Among these, green hydrogen has emerged as a promising energy vector capable of supporting industrial and energy sector decarbonization. However, its large-scale deployment still faces significant technical, economic, and infrastructural challenges.

This work assesses the potential for green hydrogen consumption within the Portuguese industrial sector, with a particular focus on high-temperature heat applications and direct feedstock use. Through a geographically detailed approach, the analysis identifies major industrial players, their potential hydrogen demand under different blending scenarios (5%, 10%, and 20% with natural gas), and their spatial distribution across the country.

The study further distinguishes between hydrogen used as a feedstock, currently concentrated in key facilities such as Galp's Sines refinery and Bondalti's Estarreja chemical complex, and hydrogen used for heat applications, notably in sectors like cement, glass, and ceramics. This mapping provides insight into how green hydrogen infrastructure could be implemented, either through centralized blending within the existing gas network or through decentralized supply to major industrial consumers.

By combining industrial, geographical, and infrastructural perspectives, this work contributes to understanding how hydrogen demand could emerge regionally and identifies potential synergies to support the development of a sustainable green hydrogen economy in Portugal.

Christian Donhauser
Director, Institute for Efficient Production Technology, Kempten University of Applied Sciences, Germany
&
Marco Susic
Scientific Assistant, Kempten University of Applied Sciences, Germany

Inline Process Optimization for Swivel Bending with Self-Adaptive Control

Swivel bending is a widely used sheet metal forming process due to its versatility and material efficiency. Despite modern CNC machinery, achieving precise bending angles remains challenging because of the combined effects of material springback, tool deformation, and machine elasticity. Conventional approaches largely depend on operator experience and iterative test pieces, which can lead to extended setup times, increased material consumption, and limited reproducibility—especially for long or thick sheets.

This work presents a real-time, self-adaptive correction method for swivel bending, aimed at overcoming these limitations. An optical laser-camera system continuously monitors tool deformation during the bending process, providing high-resolution data on the position and deflection of the bending tools. Using these measurements, the transition from elastic to plastic deformation of the sheet is identified, allowing the springback effect to be anticipated and compensated. Based on this information, process parameters—including bending angle and parabolic tool crowning—are automatically adjusted throughout the bending operation, ensuring consistent bending quality along the full length of the sheet.

The methodology is designed to integrate with existing swivel bending machinery and can reduce dependence on operator expertise while increasing production reliability. Moreover, the system is compatible with future enhancements such as data-driven models or machine learning algorithms, which could enable predictive adjustment of process parameters and further reduce the need for manual calibration.

By combining real-time measurement with adaptive process control, this approach offers a path toward sensor-driven, Industry 4.0-ready sheet metal forming, where precise, defect-free parts can be produced from the first piece. The method addresses common industrial challenges, including central sheet upwelling, uneven bending angles, and the variability introduced by material and tool differences.

Overall, this adaptive, sensor-based strategy demonstrates significant potential to improve precision, efficiency, and reproducibility in industrial swivel bending, providing a foundation for smart manufacturing in sheet metal forming.

Adnan Enshassi
Professor, Technische Universität Berlin, Germany
&
Matthias Sundermeier
Professor, Technische Universität Berlin, Germany

Strategies for Overcoming Barriers to Circular Economy Adoption in Gaza's Post War Demolition Waste

Post-war demolition waste management faces significant challenges that circular economy (CE) principles can help address. This study aims to identify the primary barriers hindering CE adoption in Gaza's post-war demolition waste sector and propose practical strategies to address them. The research employs qualitative methods and a systematic literature review to achieve these goals. Major obstacles include high costs, non-standardized demolition protocols, inefficient sorting, a lack of reuse systems, low stakeholder awareness, and unclear disposal regulations. To address these issues, the study recommends practical strategies, including standardizing demolition practices, promoting stakeholder collaboration, and integrating mobile sorting with smart technologies. To further enhance operational safety, efforts should include strengthening circular networks, launching awareness campaigns, implementing training programs for resource recovery, and establishing protocols for hazardous materials and emergency planning. Adopting circular economy (CE) approaches could enable Gaza to transform its waste management system, promote sustainable reconstruction, generate green jobs, and foster inclusive, community-led recovery. The findings offer policymakers and humanitarian actors a practical roadmap for embedding CE principles into Gaza's broader recovery agenda.

Akbar Eslami
Professor, Elizabeth City State University, USA

Conceptual Design, Analysis, and Prototype Design of a VTOL Drone

This paper presents research findings on the design, fabrication, and integration of a drone, culminating in a successful flight trial. The development process follows a multidisciplinary approach, beginning with optimizing the aerodynamic configuration to enhance performance. This is followed by achieving an optimal structural design for fabrication and integrating electronic and mechanical components to meet the intended operational goals. The primary objective of the project is to develop a fixed-wing drone capable of vertical take-off and landing (VTOL) and autonomous cruising, tailored to fulfill the requirements of a specific aerial mission.

The project was completed through a series of steps, including structural design, CAD modeling, CFD simulation, prototyping, assembly, and flight testing. Students utilized SIMNET design and simulation software to select and model key components such as the wing, fuselage, and tail, simulating the aircraft's autonomous flight to validate the design's effectiveness. The airfoil selection and wing configuration were critical aspects of the design process, as the wing's performance directly influenced the aircraft's overall efficiency. The initial wing design was created using SIMNET software and tested virtually to confirm its flight capability, with a remote control connected to the computer for validation.

The initial design underwent several iterations to enhance maneuverability while maintaining acceptable flight characteristics and was successfully tested in the virtual environment. Once the aerodynamic design was deemed satisfactory, the model was imported into SolidWorks CAD software for further refinement. This included optimizing the fuselage structure to create additional internal space, adding ribs to stiffen the wings, and reducing overall structural weight. The 3D CAD model provided a clear visualization of the drone’s geometry, estimated airframe weight, and facilitated CFD analysis to validate performance.

The drone's structural components were prototyped using a 3D printer and rigorously tested to ensure structural integrity and durability. Following this, mechanical and electronic components were installed, and the flight controller was programmed. A precise test flight was then conducted during a field trial, with flight data recorded for

analysis. This comprehensive process highlights the development of a reliable VTOL drone designed for specific applications.

Mariana Franco
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
Wagd Ajeeb
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
Eliane Cassoma
Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal
&
Rui Costa Neto
Professor and Researcher, IN+ Center for Innovation, Technology and Policy Research, University of Lisbon, Portugal

Production of Electrolytic Hydrogen and Sustainable Ammonia for Shipping Decarbonization, Based on the Portuguese Grid Mix

To guarantee the decarbonization of transportation, alternative, sustainable fuels are being proposed. For the shipping sector, as electrification on a large scale seems unlikely due to its constrictions, liquid fuels appear to be the best option, of which liquefied hydrogen and ammonia (which uses hydrogen and nitrogen as feedstocks) have gained notoriety, both having carbon-free combustions. However, production emissions must also be considered, and the vast majority of hydrogen (and consequently ammonia) is currently produced based on fossil fuels, mainly natural gas, earning the designations of grey hydrogen and grey ammonia, respectively. To combat this environmental impact, production processes based on different feedstocks have been proposed, namely electrolysis for producing hydrogen, and later ammonia, in a more sustainable way.

As a 100% renewable electricity grid is still out of reach for many countries, it is interesting to look at what the environmental impact of grid-powered production. With this in mind, the current paper conducted a life cycle assessment (LCA) of a sustainable ammonia production plant, powered by the Portuguese grid mix, with was composed of around 70% renewable energy in 2025. The plant was designed with a lifetime of 20 years, with a 10 MW capacity and a 1000 t yearly production; this is associated with a 1.5 MW electrolyzer, producing 185 t of hydrogen, and the environmental impact of only hydrogen production was analyzed as well, resulting in emissions of 6.11 kg CO_2 eq/kg H_2 and 1.35 kg CO_2 eq/kg NH_3.

When compared to those of grey hydrogen and ammonia, with emissions of 15.84 kg CO_2 eq/kg H_2 and 2.30 kg CO_2 eq/kg NH_3, respectively, these electrolysis-based scenarios result in 61% and 70% emissions reductions, representing a considerable reduction in the environmental impact of the production processes. The use of electricity from the grid mix to power these pathways could therefore serve as a mid-term solution for the production of these two alternative shipping fuels, while the country increases the share of renewable electricity production.

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Monitoring the Construction of an Arch Bridge

The Rizo de Oro bridge is the first tube arch bridge of its kind built in Mexico. It has a total length of 404.68 m that are distributed in seven spans with a central span of 299.46 m. This bridge will be the second one to cross the waters of a hydroelectric dam. The bridge will help to link 21 communities in the state of Chiapas.

For the construction of the bridge, a cable hoisting system with two provisional towers of 100 m high were built. From these towers six catenary cables of 1.5" in diameter were suspended horizontally to clear a span of 342.52 m. Along the cables a supplementary 40-ton crane trolley is displaced s and used to lift metallic segments to conform the arch.

In order to guarantee the integrity of the trolley during its maneuvers and diminish construction risks, a monitoring program of tension of the cables was implemented, in order to ensure that tension forces produced did not exceed an allowable value proposed by the designer. Ambient vibration measurements were carried out, comprising recording of accelerations generated in the cables during the lifting of segments at the construction site; these records also included wind and other sources of vibration at the location. From these records, it was possible to obtain an indirect estimated value of the tension in each of the cables by calculating their vibration frequencies.

In this paper the procedure carried out for the experimental evaluation of forces is presented in detail.

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The Effect of Hemp Fibers on the Mechanical Properties of Cementitious Mortars

Today, various chemical and mineral additives are frequently used in order to improve the brittle structure of cementitious composites. The use of natural products for the sustainability of these materials has recently become widespread and R&D studies have intensified. Hemp, as a natural material, is widely used in the construction industry as well as in many areas. Although there are some studies on the use of hemp products for the insulation sector, studies on the usability of hemp fiber in cementitious composites are still limited. In this study, the use of hemp fibers in cementitious composites was investigated by considering the properties of hemp fibers and the strength of the matrix. The fibers obtained from the stem part of the hemp plant (male and female types) were cut in various lengths (0.5, 2, and 4 cm) and added in different volumes (0.5%, 1%, and 2%) into the mortar consisting of cement and sand. Two different water/cement ratios, 0.5 and 0.7, were used and physical and mechanical properties of the cementitious composites were determined by spread, unit weight, compressive and flexural strength tests. As a result, it was found that the difference between male and female hemp genders did not have a significant effect on the physical and mechanical properties of cementitious mortars. However, long fibers negatively affected the mechanical properties of cementitious mortars. Additionally, the mechanical properties of cementitious mortars were decreased at higher fiber contents.

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Vision-Based Process Optimization for Hybrid Metal 3D Printing

Hybrid metal 3D printing integrates metal additive manufacturing with subtractive machining, usually Wire Arc Additive Manufacturing (WAAM) with Computer Numerical Control (CNC) machining to enable fabrication of complex geometries while maintaining dimensional accuracy. Although metal WAAM supports high deposition rates, geometric non-uniformity introduced during layer-by-layer deposition requires machining. In hybrid workflows, machining is often done at the lowest point on the built surface to remove irregularities. Appropriate selection of the lowest point will decrease material waste, machining time, energy consumption, and cost.

This research proposes a vision-based, Artificial Intelligence (AI)-enabled in-situ surface geometry measurement for hybrid metal 3D printing. The system employs synchronized front-view and top-view cameras to capture weld bead geometry during deposition, with scalability to additional sensors depending on part complexity. An image-processing and machine learning (ML) model was developed using multiple weld bead samples to generate the deposition parameters. A vision-based measurement algorithm, using calibrated image segmentation techniques, was developed to automatically identify the width, highest and lowest points of weld beads. Calibration was performed under varying lighting conditions, camera angles, and corner detection to minimize pixel segmentation error. Through iterative calibration refinement, high resolution measurement can be achieved. The AI algorithm is used to extract geometric features including highest point, lowest point, and bead thickness in-process.

The extracted measurement data is correlated with the ML model to optimize deposition parameters and iteratively update the ML model. This process enables closed-loop optimization of the deposition process prior to subtractive machining.

By shifting inspection from post-process to in-process, this work supports unattended and automated hybrid 3D printing process, reducing excess material removal, and improving productivity while enhancing economic sustainability.

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Signal Timing Optimization for Quadrant Roadway Intersections Using Max-Pressure Algorithm

A Quadrant Roadway Intersection (QRI) is an alternative intersection design developed to reduce vehicle delay at the crossing of two suburban corridors with high traffic demand. A QRI prohibits all left turns at the main intersection. These movements are redirected to two downstream intersections, typically controlled by traffic signals. The main intersection, relieved of left-turning traffic, operates with two signal phases, thereby increasing capacity and reducing travel time. The two secondary intersections operate with three phases. This phase configuration creates additional coordination requirements and makes the definition of an appropriate offset pattern more complex than in conventional four-leg intersections. Despite its geometric advantages, most real-world QRI rely on fixed-time control strategies. Such strategies are typically designed for average traffic conditions and do not explicitly account for dynamic queue interactions between the three signalized intersections that form the QRI system. Under fluctuating or unbalanced demand, this may lead to suboptimal signal control parameters and increased delay. These characteristics make the QRI layout a suitable case for testing adaptive traffic control approaches. To address this issue, we applied the Max-Pressure time control algorithm, which has demonstrated strong performance in coordinating signalized networks in previous studies. The algorithm relies on real-time traffic data to determine whether to terminate or extend the current phase at each local intersection, based on the queue lengths at all the adjacent intersections. For this purpose, we developed a PTV Vissim microsimulation model connected, via the COM interface, to the Python programming language. Using the QRI layout from the field, we built a realistic simulation model to evaluate the efficiency of the Max-Pressure algorithm in this intersection with an alternative geometric structure. The implemented traffic counts are representative of the applied QRI layout and were calibrated to reliably mimic field traffic conditions. To provide a benchmark for the Max-Pressure algorithm, we also developed a coordinated fixed-time signal plan, including cycle length, green splits, and offset values for the three intersections that constitute the QRI. The

fixed-time parameters were optimized using the Bee Colony Optimization technique, a swarm-based metaheuristic algorithm previously applied to traffic signal optimization problems. The comparative analysis focuses on average vehicle delay, queue length, and network throughput. The results obtained for the field-based QRI layout indicate improved adaptability of the Max-Pressure strategy under varying demand patterns and demonstrate measurable reductions in average delay and queue length compared to the optimized fixed-time control strategy.

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Human-Centered Resilience and Climate Risk Mitigation: A Systemic Learning Approach for Civil and Environmental Engineering

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Warehouses in the Supply Chain Digital, Efficient and Sustainable

Distributions centers resp. warehouses play crucial role in the distribution of goods. From a customer's perspective, key competitive factors in supply chains include short lead times, sustainable deliveries, low shipping costs, shipment tracking, etc. On the other hand, an efficient management of the processes in distribution centers are important for the economic success of distribution centers.

The aim of this paper is to present an integrated approach how these objectives can be achieved in warehouses in a supply chain. A process model for an integrated optimization of warehouses in the supply chain is presented. SMEs in particular often lack such an integrated approach to optimization.

Digitalization in combination with AI is a current trend in SC's. However, the implementation of digital tools and AI are more or less useless if no previous optimization of processes and structures have taken place in warehouses. Therefore, an approach is presented which is based on a thorough investigation of inventory management and warehouses processes. Inventory management with an analysis of e.g. safety stock policies and dead stock is crucial to define the stock levels stored in a warehouse. Lean Management as method widely known for the optimization of production systems is applied for warehouse processes to provide a base for efficiency. After establishing reasonable stock levels and efficient processes the foundation for an automation and a digitalization in warehouses is given. The digitalization and the use of AI technologies facilitate further optimizations of stock levels and the implementation of "greener" and more efficient warehouse processes. However, sustainability in warehouses begins as early as the planning phase. Therefore, aspects such as building materials, heating, lighting, etc. must be taken into account during the planning phase in order to have an integrated approach for sustainability and efficiency.

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Research of Reinforced Concrete Bridge Fire Prevention and Disaster Reduction Mechanism

With the development of China's social economy, the scale and frequency of fires are also increasing. After being subjected to a fire, the mechanical properties of reinforced concrete bridge structures will undergo significant changes. Therefore, research on the post disaster performance of this structure is receiving increasing attention. This article first provides a brief overview of the current research status of bridge fire prevention in China. Then, through the failure mechanism of reinforced concrete bridge structures in fires, post disaster bearing capacity evaluation, and post disaster repair and reinforcement, the fire prevention issues of bridge engineering are discussed in detail. Furthermore, the future development and research directions of this discipline are analyzed and forecasted.

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Black Spot Identification of Road Crashes on Highways

The paper deals with the crucial task for road safety of identifying black spots on highways. This is a central concern in transportation engineering, particularly for those roads that serve the regional mobility connecting a metropolitan area. Then, the application scenario of the proposed methodology is the extraurban Rivoltana Road (SP 14) that represents an example of this type of corridors. It is located in the eastern metropolitan area of Milan, and connects the city to surrounding municipalities, supporting a combination of commuter, commercial business, and commuter traffic. Along its alignment, the road exhibits significant variability in geometric design, traffic flow levels, and operational conditions, resulting in non-uniform safety performance.

The method is made up of the following steps:

- Segmentation of the road in uniform sections from the geometrical and functional point of view.
- Collection of crashes occurring in each segment by using geolocation information.
- Calculation of probability density functions taking into account the length of segments, their AADT and V/C ratio, and the type of segment.
- Extraction of crash occurrence by segment through a Monte Carlo technique.
- Identification of statistically significant at risk segments.

Actually two complimentary probabilistic modeling approaches were investigated. The first one uses geometric exposure and traffic saturation by combining segment length and volume-to-capacity ratio through a weighted formulation. The second one works out a hierarchical probabilistic structure based on segment type, congestion class (V/C ratio).

A comparative analysis demonstrates that both methods are capable of capturing significant crash patterns. The first proved particularly effective in detecting localized, geometry-driven risk, offering strong interpretability and clear physical meaning. Sensitivity analysis confirmed its robustness with respect to a model weighting parameter α, with the optimal performance achieved for values that balance geometric exposure and traffic congestion effects. On the other side, the second

model shows a greater global stability and lower overall prediction error, particularly when it is applied to heterogeneous networks.

The proposed methodology aids transport agencies in prioritizing specific safety initiatives and can be easily adapted to other corridors or revised as new traffic and crash data emerge.

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Role of Ports in PM Gati Shakti Mission: An Innovative National Transportation Policy of India

India's infrastructural development was sluggish for a long time due to fragmented planning and lack of coordination in operations. Ministries and departments were working in isolation leading to duplication of work, cost escalation, and inefficiency. Inefficiencies had locked India's economic potential, driving up logistics costs and reducing the competitiveness of Indian firms on the world stage. In 2015, the Government of India initiated PM Gati Shakti – National Master Plan for Multi-modal Connectivity after identifying those pitfalls as a revolutionary initiative to synergize and consolidate infrastructural projects across the country. Through this multi-department mission, Indian government aims to break the working of departments in silos, improve inter-ministerial coordination, and enhance the speed of the process of implementation of infrastructural projects to spur economic growth and competitiveness. Since Gati-Shakti mission, India has significantly improved its logistics and port efficiency, as reflected in the ***World Bank's Logistics Performance Index (LPI) 2023***. The country has moved up *to* ***22nd place in the "International Shipments" category*** and holds an ***overall rank of 38th*** in the global index. In this research, we discuss the several major ports in India, and their role in contributing to the Indian society. The most commendable accomplishment has been the ***sharp drop in turn-around time*** spent at Indian ports, which is ***0.9 days now***. This places Indian ports ahead of several developed economies, including the ***USA (1.5 days), Australia (1.7 days), Belgium (1.3 days), Canada (2.0 days), Germany (1.3 days), UAE (1.1 days), Singapore (1.0 days), Russia (1.8 days), Malaysia (1.0 days), Ireland (1.2 days), Indonesia (1.1 days), New Zealand (1.1 days), and South Africa (2.8 days)***. The less the turnover time, the shorter the response time, the improvement in trade efficiency, and lower costs. India aspires to be a major trading hub, and this amazing transformation is the result of enormous infrastructure improvements, digitalization, and regulatory reforms implemented through PM Gati Shakti. It is widely augmented by automation investments, dedicated freight corridors, port connectivity, specialist cargo handling terminals, and simplified customs procedures that have reduced congestion and boosted efficiency.

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Risk Perception and Barriers to Electric Scooter Prevalence

The increasing crash rates involving electric scooters (ES) have become a significant public safety concern, particularly due to the novelty of this micro-mobility mode and the lack of comprehensive research on associated risks. Understanding how individuals perceive these risks is critical for the safe and sustainable adoption of ES-sharing services. This study explores key factors influencing the adoption and use of ES, with a focus on risk perception, cultural norms, technological familiarity, and the adequacy of physical infrastructure. By examining travel behaviours, common risks, and barriers to ES adoption, the research seeks to identify solutions that enhance safety and increase the prevalence of ES.

The study utilized a structural equation model (SEM) to analyse variables affecting risk perception and how these influence the willingness to use ES. Key factors included risk perception, environmental safety, positive attitudes towards scooters, ease of using shared services, willingness to share personal scooters, subjective norms, and gender-related attitudes. Data were collected from 254 participants in Israel, including 50 active ES users. Results revealed that 48% of ES users had experienced near-miss incidents, and 38% frequently used ES on vehicular roads. The primary risk identified by participants was the dangerous behaviour of drivers on these roads, while the most significant barrier to scooter adoption was the perceived lack of safety, particularly on roads shared with motor vehicles.

The SEM results demonstrated that risk perception was strongly influenced by gender-related attitudes, with subjective norms indirectly affecting positive attitudes towards ES. Social expectations and concerns about safety had a negative impact on both the willingness to use and share ES. The availability of safe, designated lanes for scooter uses significantly contributed to more favourable attitudes, enhancing the likelihood of both personal and shared use of ES. Additionally, the study found that improvements in physical infrastructure, such as the creation of separate scooter lanes, would greatly reduce perceived risks and increase adoption rates.

The study highlights the importance of addressing safety concerns through better infrastructure and public awareness campaigns. Education about safe driving behaviours, stricter enforcement of traffic laws, and improvements in the road environment for ES users could reduce crash rates and mitigate risk perceptions. Moreover, societal attitudes, particularly the influence of subjective norms, play a critical role in the willingness to use shared ES services. By understanding these social and psychological barriers, policymakers can implement targeted strategies to overcome resistance and promote safer, wider usage of ES as a sustainable transportation option.

The findings emphasize the need for collaborative efforts among transportation planners, policymakers, and scooter-sharing service providers to address the risks associated with ES and to create an environment where they can be used safely and efficiently. Addressing these barriers will be key to realizing the potential benefits of ES as a solution to urban congestion, pollution, and transportation accessibility.

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Beyond Crash Counts: Integrating Volume, Severity, and Exposure for Micromobility Safety

Electric scooters (ES) have become a visible part of urban mobility, offering flexible low-emission travel while introducing new safety challenges. Because ES riders are vulnerable road users, cities need analytical tools that go beyond simple crash counts. Current road-safety practice often focuses either on crash frequency or on severe outcomes, but rarely on their interaction. This study argues that crash volume and injury severity are distinct dimensions of risk that should be analyzed together but interpreted separately.

We present a multi-source Business Intelligence (BI) framework designed to support urban road-safety decision-making, demonstrated through a case study in Tel Aviv-Jaffa (TAJ), Israel. The system integrates police-reported crash data for 2013-2025, municipal spatial layers, shared micromobility trip data as an exposure proxy, enforcement records, and rider survey and observation data. Although the empirical case is local, the framework addresses a broader challenge faced by many cities: fragmented datasets and limited visibility into actual micromobility risk patterns.

The main finding is a systematic divergence between crash volume and severity. High crash volumes tend to cluster in predictable high-exposure contexts such as mid-block street segments, daytime hours, and weekdays. Severe outcomes, however, are concentrated under specific high-risk conditions, including nighttime environments, weekends, intersections, and infrastructure-related hazards. This distinction matters for policy. A location or user group with relatively few crashes may still represent a serious safety problem if the injury consequences are disproportionately severe. For example, intersections account for a minority of ES crashes in the dataset but show nearly double the severe injury rate of other road segments. Likewise, low-frequency user groups such as young riders, older adults, tandem riders, and non-local users show elevated severity levels despite limited representation in total crash counts. Pedestrians involved in ES crashes also display heightened vulnerability.

A second contribution is the integration of exposure and underreporting considerations. Police-reported databases, widely used in international studies, capture only part of the ES crash universe and tend to underrepresent solo incidents. By combining crash data with trip and survey evidence, the analysis suggests that standard administrative datasets may function as severity-filtered samples rather than full representations of risk. This has important implications for cross-city comparison, benchmarking, and policy evaluation.

The BI framework translates these insights into interactive dashboards that connect evidence to action. High-volume contexts support prevention-oriented interventions such as traffic calming and infrastructure redesign, while high-severity contexts call for protective measures, targeted enforcement, and behavior-focused policy. Although the case study reflects local conditions in Tel Aviv, the methodological contribution is transferable to other cities and can support more precise, data-driven micromobility safety planning.

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Performance Review of Cabinets in Nuclear Plants by Application of Small Seismic Bearings

In South Korea, where over half of the nuclear power plants have been operating for more than 20 years, concern has grown regarding the safety of nuclear facilities against design-basis earthquakes due to the significant seismic impact from an earthquake near a plant over a decade ago. Consequently, research on the seismic performance of safety-related equipment within operating nuclear power plants is currently underway. This paper aims to analyze the seismic performance improvement effects when applying isolation technology to enhance seismic safety, specifically focusing on the partial isolation of major equipment within the plant rather than the plant buildings themselves. Unlike bearings for building isolation, small isolation bearings for equipment isolation have characteristics that make it difficult to design for low natural frequencies to absorb seismic energy, due to manufacturing challenges such as rubber laminate sheets and molding. Here, a structural analysis model of a recently developed small-sized equipment seismic isolation bearing is created for the Load Center, one of the cabinets controlling major equipment within the nuclear power plant. Seismic analysis is performed applying a design-exceeding earthquake to examine the influence and effectiveness of equipment seismic isolation within the building. The results indicated that a certain level of improvement in the seismic performance of the cabinet structure could be expected. These analytical results were verified through a three-axis vibration table test simulating the conditions.

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Smarter Homes for Aging in Place: From Insight to Immersive Design

Aging in place has become a central priority for older adults seeking to maintain independence, safety, and quality of life. Smart home technologies are frequently proposed to support this goal through health monitoring, safety alerts, environmental control, and communication support. However, real-world adoption remains uneven, indicating that technological capability alone is insufficient for successful implementation. This study examines smart home adoption for aging in place through a combined user-centered survey and built environment implementation framework, enhanced with immersive visualization tools.

A cross-sectional survey of 50 older adults (aged 65–89) was conducted to assess device exposure, perceived value, privacy concerns, usability barriers, support availability, and willingness to adopt specific smart home functions. Smart healthcare-related devices explored include wearable health monitors, fall detection sensors, remote vital sign tracking systems, medication management tools, and voice-activated assistants. Descriptive statistics, reliability testing, group comparisons, and regression analysis were used to evaluate adoption-related outcomes.

Results indicate that smart home adoption is multidimensional rather than reducible to a single readiness score. Support availability emerged as the strongest and most consistent predictor of positive adoption attitudes, while prior smart device exposure was associated with openness to broader integrated systems. Privacy concerns did not function as a barrier alone but acted as a governance condition shaping acceptable and trusted use of technologies.

To address usability and understanding gaps, the study incorporates Building Information Modeling (BIM) and immersive visualization platforms such as EON-XR. EON-XR enables aging users and caregivers to interact with virtual smart home environments, allowing them to visualize device placement, simulate real-life scenarios (e.g., fall detection response or medication reminders), and experience system functionality prior to installation. This approach improves user comprehension, reduces uncertainty, and facilitates informed decision-making.

These findings informed the development of a phased, layout-based implementation framework beginning with low-intrusion technologies and progressing toward integrated monitoring and automation systems. The integration of BIM with EON-XR further supports the creation of digital twins for personalized design, enabling stakeholders to align smart home layouts with user needs, accessibility requirements, and healthcare functions.

This study contributes an evidence-based pathway for aligning smart home design, privacy governance, support structures, and built environment planning. It demonstrates that combining technical solutions with immersive visualization tools enhances user acceptance and supports more effective adoption of smart homes for aging in place.

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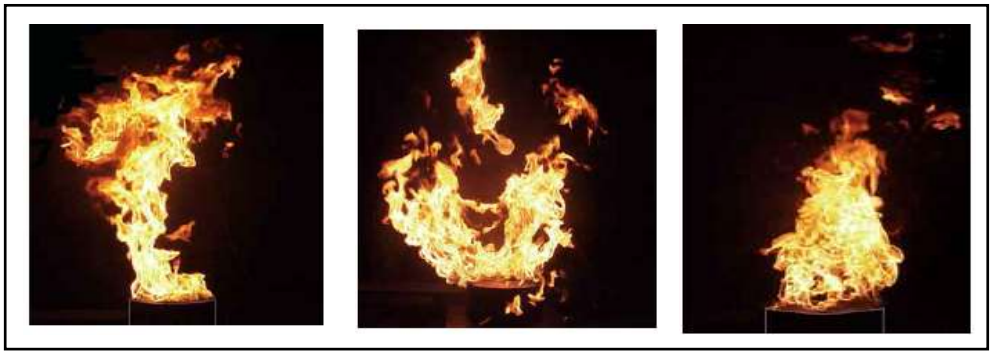
Large Eddy Simulation of Fire Suppression via Water Mist Using FDS and Firefoam

As an alternative to halogenated alkyl fire extinguishing agents, sprinklers are widely used in industry facilities since it is shown applicable to suppression of gas, liquid and solid combustible fires. Understanding the fire spread and suppression mechanisms increases the performance of protection systems to reduce fire damage.

This study evaluated the performance of two widely used fire simulation codes for predicting heptane pool fires suppression via water mist. The simulation models used are Fire Dynamics Simulator (FDS), which applies a low-Mach-number approximation, and FireFOAM, which performs a compressible flow analysis. Turbulence analysis is conducted using the Large Eddy Simulation (LES) technique. The eddy dissipation model (EDM) is applied to simulations of pool fire suppression, and the eddy dissipation concept (EDC) model, which considers a four-step chemical reaction, is applied to fire simulations. Both simulation codes reasonably predicted the temperature and key chemical species, such as O_2 and CO_2 concentrations. FDS predicts slightly lower temperature stratification than FireFOAM after activating water mist.

From the present work, it is found that water mist application allows to achieve maximum droplet evaporation in the thermal plume over a liquid pool fire. As a result, the water mist can't be transported to the fire source during the fire-water interaction period due to upward buoyancy-induced flow. Reduction in flame-to-liquid surface radiation heat feedback via cooling of thermal plume by water mist does not conduct to extinguishing of a fully developed turbulent fire. Through the analysis on heat release rate, gas temperature, convection/radiation heat flux and chemical species, it is concluded that in a hot environment, a consecutive efficient cooling of the thermal plume does not lead to the fire suppression due to combustion-supporting effect by applying a finely divided water mist, as shown in the following figure.

Figure 1. *Fluctuation of Flame Structure After Applying a finely Divided Water Mist*



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