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INTERNATIONAL CONFERENCE ON CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

MAY 23-25, 2022 | MUNICH, GERMANY

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FOREWORD

It is our pleasure to invite all scientists, academicians, young researchers, business delegates and students from all over the world to attend the International Conference on Civil, Structural and Environmental Engineering will be held in Munich, Germany during May 23-25, 2022.

CIVILMEET2022 Conference provides a platform of international standards where you can discuss and share persuasive key advances in Civil, Structural and Environmental Engineering. In addition to Presentations, Workshops, and Discussions, the conference also offers a unique venue for renewing professional relationships, networking and for remaining up-to-date variations in our challenging and expanding discipline.

CIVILMEET2022 we have not only increased the number of opportunities for you to network with colleagues from across the world but also introduced more focused sessions that will feature cutting edge presentations, special panel discussions, and livelier interaction with industry leaders and experts. We're looking forward to an excellent meeting with scientists from different countries around the world and sharing new and exciting results in Civil, Structural and Environmental Engineering.

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Use of Warm Mix Asphalt with Reclaimed Asphalt Pavement to Reduce Climate Change

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Abstract

The warm mixed asphalt (WMA) technology has gained a lot of interests in the recent years in academia, state agencies and industries. WMA technology allows reductions in production and compaction temperatures guaranteeing relevant environmental cost saving benefits. Thus, a test section was established to study and evaluate the performance of a typical additive in WMA pavement with Reclaimed Asphalt Pavement (RAP) on rutting, fatigue cracking and thermal cracking resistance. Route 102 was rehabilitated through Full Depth Reclamation (FDR) in 2015 and was used as case study. One of half part of road was built with HMA base and surface layer using a typical additive and the other half was built with WMA base and surface layer.

The asphalt binder was tested at different dosages of additive using Dynamic Shear Rheometer (DSR), Rolling Thin Film Oven (RTFO), Pressure Aging Vessel (PAV), Multiple Stress Creep Recovery (MSCR) and Bending Beam Rheometer (BBR). From the overall test, it was concluded that 0.7% additive would lessen pavement damage due to rutting, fatigue cracking and thermal cracking.

Based on the results of binder test, Hot Mix Asphalt (HMA) and WMA specimens containing 20 % RAP were prepared using PG 58-28 asphalt binder and Superpave Gyratory Compactor (SGC). From the volumetric analysis of both HMA and WMA specimens, it was found that the optimum binder content (OBC) for HMA with 20% RAP is 5.3 percent and the OBC for WMA (0.7% additive) with RAP is 5.6%. It concluded that the required amount of neat regular asphalt binder for WMA specimen was higher than the one required by HMA. HMA and WMA Specimens both contained 20% RAP were prepared at OBC and performed indirect tensile strength test (IDT). The test indicated that the performance of HMA mixtures was better than WMA with same amount of RAP. Four specimens were prepared to predict the performance of asphalt pavement for the dynamic modulus and the master curve. Two HMA specimens each were prepared with and without RAP. Similarly, other two WMA specimens were prepared with and without RAP. These four specimens were tested with the Asphalt Mixture Performance Tester (AMPT) machine and developed the master curves for each specimen. The results of the material testing were used to predict the performance of each test sections by using the AASHTOWare Pavement ME Design (PMED) software.

It was found that the WMA-RAP mixtures can improve asphalt mixture stiffness and perform better in rutting resistance comparing to the HMA mixtures with and without RAP. However,

it was learned that WMA mixtures without RAP showed poor performance against rutting comparing to the HMA with and without RAP. It has been observed that both sections have same value in Pavement Serviceability Index (PSI) and in International Roughness Index (IRI) in 2022. It is hoped that the use of WMA with RAP will help reducing the climate change if it performs as same as or better than HMA.

Keywords
Warm Mix Asphalt; Reclaimed Asphalt Pavement; Hot Mix Asphalt; Climate Change.

Biography
Kang-Won Wayne Lee is a faculty of Civil & Environmental Engineering (CVE) and Director of Rhode Island Transportation Research Center (RITRC) at University of Rhode Island (URI). He worked as CVE Director of Graduate Studies from 1996 to 1999 and served as Chairperson from 2005 to 2008. In 1992, Prof. Lee established the RITRC, the recipient of a $12 million research grant under the TEA21 in 1998. He also assisted University of Maine to receive USDOT Region 1 UTC grant ($14.7M) in 2018.

Prof. Lee earned his B.S. degree in Civil Engineering from Seoul National University in 1974 and received his M.S. degree in Geotechnical Engineering from Rutgers Univ. in 1978. He received his Ph.D. degree in Transportation Engineering from the University of Texas at Austin in 1982. He assisted Late Prof. Thomas W. Kennedy who developed Superpave asphalt mix-design during and after his doctoral program. He began his higher education teaching career at the King Saud University in 1982 and joined the URI faculty in 1985.

Prof Lee's research interests are focused on Intelligent Transportation Infrastructure and Systems (ITIS), Sustainable Infrastructure and Energy. He is a founding member of the New England University Transportation Center at MIT and the New England Transportation Consortium. He served as President of the ASCE RI Section for 2006-07 and has been elected as a Fellow in 2008. He made over 100 professional presentations, and published over 120 technical papers.

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Photogrammetric UAV Technologies Aimed at Monitoring of Infrastructures

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Abstract

Road Networks are key drivers for economic success in any city, region or country. However, globally today there are enormous challenges in trying to ensure the road networks are kept in good and acceptable states throughout their life. These challenges arise from continually decreasing budgets, which now will be further impacted by the current pandemic driven economic crises. The deficiencies often result in ineffective data collection and management practices. This research targets alleviating some of these difficulties whilst trying to help road managers deliver better pavement management strategies and systems. Specifically, the concepts of sustainable data collection and analyses are tackled. The study identifies low-cost but accurate strategies and techniques to collect road condition data mainly using simple and readily available devices such as smartphones and drones. Imagery is collected from smartphones and cameras, and the images are used in two important workflows. The first develops deep learning models capable of detecting where pavement distresses occur to carry out hotspot analyses on road networks whilst providing an idea of the severity of damages. The second uses images in a 3D modelling workflow to reconstruct and segment pavements to pinpoint and analyse the distresses producing metric assessments of damage levels at specific points within road networks. Several case studies are built using different equipment parameters and in different environmental conditions to validate the techniques and the models developed. In this presentation, I will show a case study of smart monitoring applied on pavement road to detect the distresses and verify the real state of life of the infrastructures. The methodology used is based on the photogrammetric technique that allow us to carry out a 3D model that has the follow features: low cost process, low time process, user friendly, repeatability. These features consent to make a planning with frequently acquisition to guarantee a reliability monitoring. It works with the comparison between the dense clouds of the 3D models acquired in different moment: the mean square distance between the dense clouds shows where there has been a new distress or an increasing of an old distress. The study identifies low-cost but accurate strategies and techniques to collect road condition data mainly using simple and readily available devices such as smartphones and drones.

The research has three key concept: the first one is the application of data analysis using limited data sets to understand historical and future road maintenance interventions; the second one is the application of image based 3D modelling and analysis of pavement distresses; the third one is the application of deep learning to detect and pinpoint pavement distresses.

Keywords
Monitoring; SfM; Detection; pavement distress.

Biography
Laura Inzerillo is Associate Professor at University of Palermo within the Department of Engineering. Graduated cum laude in Management Engineering at University of Palermo, 1995. Ph.D in Digital Survey and Representation of the landscape and Architecture at University of Palermo in 1999. She won a fellowship ata Columbia University from 1999 to 2000 with the confirmation of researcher at Columbia University from 2000 to 2003 at MUD. She won a post PhD fellowship at Univesrity of Palermo from 2000 to 2004 when she became researcher. Her field of expertise are the digital survey, 3D representation, Descriptive Geometry, reverse Engineering, monitoring.

She is editorial member of several International Journals, reviewer member in other several International Journals, chief in editor of a special issue in MDPI Journal. She is actually authors of about 150 paper, 3 monographies, 2 chief in editor books and she won a best award paper. She has been involved in several international and national projects. Actually she is involved in SMARTI ETN - Sustainable Multi-functional Automated Resilient Transport Infrastructures European Training Network HORIZON20-20; in REMED - Application de l'économie circulaire pour une construction durable en Méditerranée ENI CBC MED European Union.

High-performance Polylactic Acid Compressed Strawboard Using Pre-treated and Functionalised Wheat Straw

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Abstract
This study aims to provide insights into the development of high-performance compressed strawboard composites. Incorporating waste wheat straw particles into a PLA matrix results in reduced thermal conductivity and the cost of the final composites. Thus, this material has a promising potential to be a useful thermal insulator in the building industry. However, its high concentration of hydrophobic elements, i.e., waxy cuticle layers, inorganic silica, and extractives, results in inadequate surface characteristics, diminishing the interfacial bond quality between the wheat straw and polymer matrix. To overcome these shortcomings, as a feasible and cost-efficient approach, a pre-treatment coupled with surface functionalisation were developed to enhance the quality of wheat straw particles to be used for the development of high-performance polylactic acid (PLA) compressed strawboard. Eco-friendly hybrid pre-treatment (i.e., hot water followed by steam, H+S) and surface functionalisation processes employing attapulgite nanoclay (AT) and graphene nanoplatelets (G) were used to obtain an appropriate wheat straw surface quality while increasing its compatibility with the PLA matrix. The successful pre-treatment and surface functionalisation of wheat straw particles was verified through several characterisation techniques. Tensile strength and water absorption properties of compressed strawboards were also examined to assess the impact of pre-treatment and surface functionalisation of wheat straws.

Keywords
Bio-based polylactic acid composites, wheat straw, pre-treatment, surface functionalisation.

Biography
Dr. Mehdi Chougan is a Marie Skłodowska-Curie Research Fellow at Brunel University London, Department of Civil and Environmental Engineering. Dr Chougan obtained his PhD in “Graphene-engineered cementitious composites” from the University of Rome “Tor Vergata”, Italy, in 2019. After the PhD completion, he worked as a postdoctoral research associate on “High-Performance Compressed Straw Board (HPCSB): A New Generation of Building Materials” project funded by the Engineering and Physical Sciences Research Council (EPSRC) at Brunel University London.
He is an outstanding young researcher in the field of cementitious composite materials, especially in graphene-engineered cementitious composites and additive manufacturing of

alkali-activated cementitious composites. His research focuses on three areas: (i) the design and optimisation of 3D printable alkali-activated materials (AAM) and manufacturing strategies, with the aim to enhance the sustainability and productivity of the construction industry. Key topics concern the inclusion of different types of additives, including graphene-based materials, nano clay, and fibres, focusing on rheology modifications and performance optimisation. (ii) Bio-based composites, such as lightweight compressed strawboard (CSB) for the construction industry. (iii) the design and optimisation of low-carbon concrete using cement and natural aggregate replacement procedures to reduce concrete's carbon footprint. Some of his research works have been published in prestigious journals such as Materials and Design, Industrial Crops and Products, Journal of building engineering, etc. He is a RILEM Technical Committee member of "Carbon-based nanomaterials for multifunctional cementitious matrices" and a guest editorial board of the special issue on "Benefits of Alkali Activated Materials toward Sustainable Construction: Latest Advances and Prospects" in the journal of sustainability (MDPI).

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Recycled Cement in More Sustainable Concrete – Towards Green Concrete

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Abstract

Stringent targets have been defined by the concrete industry in order to reduce the greenhouse gas emissions, the concrete waste disposal and the excessive consumption of natural resources. Among other strategies, the reuse of concrete waste and the development of alternative cements have been focus of intensive research, towards more sustainable concretes. In this regard, relevant research have been carried out in the department of civil engineering of Instituto Superior Técnico, aiming the development of more eco-efficient concrete produced with recycled cement (RC) retrieved from hardened concrete debris.

In the last decade various investigations have been conducted concerning the mechanical characterisation of pastes or mortars with RC obtained from laboratory cement waste pastes. However, the characterisation of concretes produced with recycled cement, as well as the retrievement of recycled cement directly from concrete waste, have been barely studied.

This communication presents the recent findings on the production and behavior of concrete with recycled cement obtained from concrete waste (RCC) and from cement paste waste (RCP). RCC was obtained from the cement fraction of concrete waste according to a novel separation method patented by the authors. With this method, the cement fraction can be recovered with nearly 90 vol% purity. The consideration of RCP allows the more accurate analysis of the maximum potential of recycled cement.

The concretes were characterised in terms of mechanical strength (compressive and tensile strength), modulus of elasticity, shrinkage, transport properties (oxygen permeability, capillary absorption), chloride migration and carbonation resistance. Concretes were produced with different w/b (0.35- 0.65), and 5 to 100% replacement of Portland cement (PC) with RC.

In general, the mechanical strength was only little affected by the RC incorporation, showing a maximum strength reduction of only 17% for 100% replacement of PC with RC. Due to the high water demand of RC, the addition of super plasticizer (SP) greatly improved the RC efficiency. The addition of SP had a significant effect on the dispersion of cementitious particles and in improving the concrete compactness.

Concrete with RC had comparable durability to that of PC concrete, regardless of the RC content. Durability and mechanical properties were more affected by the w/b than by the type of binder (RC or PC). Moreover, RC may refine the microstructure due to the reduction of the interparticle space. However, the total open porosity tends to be lower in PC concrete.

A significant improvement was found in the mechanical and durability performance of RC concrete compared to that with the same content of non-treated concrete waste or commercial filler. RC proved to be a very effective supplementary material, reducing the

carbon footprint of concrete without significantly affect their mechanical and durability proprieties. Concrete with RCC showed similar mechanical and durability behavior to that with RCP, for up to 30% incorporation.

Concrete with only RC could be produced with strength class C25/30 and similar to higher durability of PC concrete of the same strength class. This indicates that 100% recycled concrete can be attained towards a truly circular economy of the concrete industry.

Keywords
Recycled cement; sustainable concrete; concrete waste; low-carbon cement.

Biography
José Alexandre Bogas is Assistant Professor of the Construction Group, Materials of Construction area, in the DECivil, Instituto Superior Técnico, Universidade de Lisboa, where he has been lecturing since 1997. As a member of the Civil Engineering Research and Innovation for Sustainability (CERIS), his domain of expertise falls within the characterization and behaviour of materials, more specifically in the area of cement-based materials and special concretes. He is the author of 60 papers in peer-reviewed high-impact ISI/Scopus journals, 3 book-chapters, over 50 conference communications and 1 international patent. He is also the principal coordinator of three national research projects funded with 0.7 million euros and member of 7 research projects funded through competitive calls for a total of about 2.7 million euros.

Beyond Geophysics, Using Electromagnetic Waves for Geotechnical and Geoenvironmental Applications

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Abstract

The application of electromagnetic (EM) waves for geotechnical and geoenvironmental engineering has traditionally been limited to geophysical nondestructive testing and characterization. However, there is a tremendous potential for the use of EM waves for other purposes beyond testing and characterization. EM waves can interact with charged and neutral polar (e.g., water molecules) particles through which, several properties of and mechanism within the soil, water, and groundwater.

In this work, a summary of various aspects of the traditional using EM waves for geophysical applications will be described first. Then various impacts of EM waves on soil and groundwater and using them for remediation or manipulating soil properties for other potential applications are discussed. This portion will include phenomena first observed by our team and governing equation developed by our team describing these impacts. As an example,

the effect of electromagnetic (EM) waves—with minimal heat generation—on various transport mechanisms such as diffusion and how to improve and expedite the clean-up process using air sparging or similar technologies are discussed. Another example is the impact of EM waves on the hydraulic conductivity of various soils. These effects are studied through the development of experimental models and numerical forward models. The governing equations are then found using inverse models.

Keywords

Electromagnetic Waves; Geotechnical; Geoenvironmental; Geophysics; Remediation.

Biography

Dr. Farid is a Professor at the Civil Engineering Department. He joined the faculty in Civil Engineering at Boise State as an Assistant Professor in spring 2008. He was first promoted to Associate Professor in 2013 and then to Professor in 2020. Before joining Boise State, he was an Associate Research Scientist at CenSSIS (The Gordon Center for Subsurface Sensing and Imaging Systems), Northeastern University, Boston, MA. From 2001-2003 he was a Research Assistant at CenSSIS and Civil & Environmental Engineering Dept., Northeastern University, Boston, MA where he received his Ph.D.

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Sustainable Advances in the Use of Advanced Concrete and Composites Materials in Infrastructure Engineering Applications to Extend Structural Service Life: A US Perspective

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Abstract

Portland cement is often considered an essential input into the production of concrete, which is a primary building material for the construction industry. Large demand for the use of concrete to construct infrastructure buildings, roads, bridges, and dams has increased tremendously. Cement production is growing by 2.5% annually, and cement consumption is expected to reach 3.7-4.4 billion tons by 2050 (Benhelal et al. 2013, Rubenstein 2012). Cement production is also a key source of CO2 emissions, due to the extreme heat required to produce it. Each ton of cement requires 4.7 million BTU (1,377 kwh) of energy and generates nearly 1 ton of CO2, which accounts for 5-7% of global CO2 emissions (Damtoft et al. 2008). With growing demand for cement in use of new concrete infrastructure projects, the sustainability of concrete is a very real concern in the coming decades. One solution for this concern is the use of supplementary cementitious materials, such as fly ash, as a replacement for cement. Advances in concrete constituent materials and rheology has allowed for improved mechanical and durability properties with reduced Portland cement usage.

Another approach is to utilize noncorrosive materials in concrete such as composites or innovative coating technologies for mild steel reinforcing materials in concrete to minimize the potential for steel corrosion and thereby extend the service life of bridges and other infrastructure system. By reducing the amount of cement usage on the front end and incorporating approaches to minimize or eliminate the potential for reinforcing steel corrosion, which dramatically reduces the service life of structures, a more sustainable path exists to be a better steward as it relates to bridge engineering.

This research will highlight recent advances in Bridge Engineering in the United States involving the development and implementation of innovative advanced concrete including High Strength-Self Consolidating Concrete (HS-SCC), High Volume Fly Ash-Self Consolidating Concrete (HVFA-SCC), Fiber Reinforced Polymers (FRP)/Fiber Reinforced Cementitious Matrix (FRCM) for new construction and repair as well as innovative Hybrid Composite Beam (HCB) Bridge Systems. New coating techniques for mild steel reinforcing will also be highlighted.

Keywords
Extended Service Life; Sustainability; Advanced Concrete; Composite Materials.

Biography
Dr. John J. Myers is a Professor in structural engineering at Missouri S&T in Rolla, Missouri, USA and has thirty years of research experience in working with and developing sustainable materials for infrastructure and structural engineering applications. He received his PhD and MS from the University of Texas at Austin in 1998 and 1994 respectively and a BAE degree from Penn State University in 1987. He currently serves as the Deputy Director for the Missouri Center for Transportation Innovation (MCTI), a state-wide Transportation Center in Missouri, USA, and he has previously served as the Director for the federally funded Missouri S&T National University Transportation Center. He has published more than 400 technical publications and reports with secured reoccurring funding from agencies such as FHWA, NSF, DHS, USDOEd, AFRL, and DOT

projects. He is a registered Professional Engineer (PE) with more than 10 years of consulting experience. He is a Fellow of 5 technical societies and an expert in structural evaluation, sustainable material development, long-term assessment, and in situ evaluation.

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Lessons from Geo-Solar Exergy Storage Technology (GEST) for Housing Applications in Central New York, USA

Lowell E. Lingo Jr.[*], Mark Bomberg, Kristin I. Lingo

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Abstract

We know from the widespread use of ground-source heat pumps that the ground surrounding a building can store sufficient energy for annual climate control. Through development of Geosolar Exergy Storage Technology (GEST) in our test facility we have learned that in cold climates one can dramatically reduce energy consumption even without the use of a heat pump. This is achieved by designing or retrofitting a building with a dynamic, ventilated skin coupled to the ground thermal storage. Using water and/or air circulation through the envelope, one can leverage large quantities of low-grade energy to mitigate, both diurnal and seasonal temperatures in the building structure. While it is straight forward in a cold climate, it is also possible with some modification in the warm climates.

Since then, we have developed much more complex systems, We are currently focusing on incorporating fundamentals learned in the GEST test facility, i.e. using the large surface areas and thermal mass of the modified envelope for heat exchange and storage, with complex control systems we have since developed using shallow thermal storage capabilities and water sourced heat pumps. These efforts are leading toward a unified methodology for building/ retrofit solutions in any climate.

Keywords

Exergy; Geosolar; Dynamic Envelope; Ground-coupled.

Biography

Lowell e. Lingo, JR, Ph.D. (2011) on Design of Integrated Low-Grade Geosolar Exergy System for Heating and Cooling in Residential Construction, obtained MSc and BSc in Environmental Engineering at Syracuse U, NY. He teaches at State University of New York Morrisville State College and has taught at and performed research in both the departments of Electrical and Mechanical at Syracuse U as well as leading DFI Enterprises, Inc. During his professional career through DFI, Dr. Lingo worked in development of medical electronic instrumentation, e.g. measurement of muscle activity and respiration in patients with swallowing disorders for Johns Hopkins Medical Center and U of Illinois, Champaign; and measurement of glottal function in MRI environment for U. of Pittsburgh. He also worked with design and construction of instrumentation for water pollution control, and prototype development for renewable energy applications including control systems. Since 2008, the focus of DFI has turned to exergy management in residential buildings.

The Research Project Tyre4BuilIns

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Abstract
Currently, waste management and energy consumption are two of the major concerns of humankind. In Europe are produced around 355 million tyres per year and buildings account for 40% of the total primary energy consumption. Thermal bridges may be responsible for up to 30% of heat losses in buildings. The Lightweight Steel Framed (LSF) system has proliferated worldwide over the last years. The economic panorama triggered the need for innovative construction processes, also in Portugal. LSF system emerged as a new trend that could be implemented indoors and exported, representing a major economic opportunity for national industry. Moreover, LSF system is very suitable also to buildings refurbishment, being this one of the main current strands in the construction sector. LSF system outstrips tradition construction in such fields as pre-fabrication, construction process (e.g. dry construction), building quality and sustainability. As an industrialized system, LSF buildings benefit from superior quality achieved by factory high quality control. The main goal of the research project Tyre4BuildIns – "Recycled tyre rubber resin-bonded for building insulation systems towards energy efficiency" was to develop a new cost-effective eco-friendly thermal insulation composite material, that will be used mainly, but not exclusively, as a thermal break in LSF building structures. The main idea was to take advantage of recycled tyre rubber as a main raw-material and mixing it with an advanced state of the art insulation material (aerogel). The performance of this new composite insulation was evaluated and optimized at material level and building elements level (e.g. walls), in order take maximum thermal and acoustic advantage of it. Moreover, its environmental impacts and costs were also assessed from a life cycle perspective. In this communication it will be presented an overview of the research performed under the scope of the Tyre4BuildIns project, as well as the main outputs achieved.

Keywords
Tyre4BuildIns research project; Recycled tyre rubber; Thermal/noise insulation; Energy efficiency.

Biography
Paulo Santos [ORCID 0000-0002-0134-6762] is currently Assistant Professor in Department of Civil Engineering of University of Coimbra, Portugal. He is an integrated member of ISISE (Institute for Sustainability and Innovation in Structural Engineering) research centre, Functional Performance (FP) research group. The main actual scientific research fields are Thermal Behaviour, Energy Efficiency in Buildings and Sustainable Construction. He is

author of around 160 scientific publications, among books (4), book chapters (3), articles published in peer-reviewed scientific journals (52) and papers published in proceedings of scientific conferences (96). He has around 2,000 citations and 60,000 reads on Research Gate network (Berlin), with an h-index of 22. He was supervisor and co-supervisor of 47 master and 3 doctoral theses already completed within his research topics. He participated in around 12 funded European and Portuguese research projects, being nowadays the Principal Investigator of the Tyre4BuildIns – "Recycled tyre rubber resin-bonded for building insulation systems towards energy efficiency" research project. He was member of the scientific committee and/ or organizer of several national and international scientific conferences. He reviewed, by request of the editors, as member of the journal scientific committee, 94 articles submitted to international journals (see publons website). He is member of iiSBE – "International Initiative for a Sustainable Built Environment" (2011, -) and TC14 – "Sustainability & Eco-efficiency of Steel Construction" of the "European Convention for Constructional Steelwork" – ECCS (2008, -).

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On Ecological Design and Retrofitting of Residential Buildings

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[4]Assistant Professor, D. Eng., Dept. of Automatic Control & Info. Tech., Cracow Uni. of Technology, Poland

Abstract

Four decades after passive houses were designed in the United States and built in Canada, when adding the SAR coV2 pandemic expertise we arrive to a unified approach to the next generation of new and retrofitted residential buildings.This review paper summarizes two research papers and focus on multi-disciplinary synergies. Current transition to a science basis construction was started with the integrated design process (IDP)and brings building physics (science) to reduce effects of climate change.

We analyze heating, cooling and ventilation aspects of housing in atechnology called Environmental Quality Management (EQM) or EQM-retro when applied to interior retrofitting. New elements inthis technologies are:

1) Introduction of a two-stage construction process for both new and retrofit cases, modifies financing patterns. In the first stage one seeks for the best possible performance within a prescribed investment limit; in the second stage one tries to reduce cost of the required energy efficiency level.
2) Building automatics control system (BACS) permits to control the contribution of thermal mass under a time-table of the adaptable indoor climate as well as a full integration of HVAC with the building structure. This is accomplished with assistance of monitoring and performance evaluation (MAPE) system. Introducing BACS into the design process offers improved integration of building subsystems and introducing energy optimization in the post-construction stage.

The EQM is a result of aggregating many practical improvements already applied in practice toemphasize need for occupant-controlled comfort, energy efficiency and interaction of buildings with smart energy grid.

Keywords

energy efficiency; building automatic control; energy use under field conditions; two-stage construction process; cost-benefit evaluation; deep and affordable retrofit of residential buildings

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Measuring Construction Workers' Real-Time Situation Awareness: Using Wearable Technologies

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[1] Sid and Reva Dewberry Department of Civil, Environmental and Infrastructure Engineering, George Mason University, Fairfax, VA

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Abstract

Human error (e.g., poor decisions or unsafe actions) is a main causal factor in up to 80% of all workplace accidents across a breadth of industries. To the extent our limited capacity for information processing capacity is a major source of such errors, a better understanding of cognitive processes will yield more effective methods for predicting and reducing the poor decisions that put workers at risk. Accordingly, this study will complete a series of eye-tracking experiments to build an error-detection framework - the Human-Error Detection Framework - that computes the likelihood of human error in occupational settings to enable proactive countermeasures to keep workers safe. Subsequently, to extend the value of this framework, this project will enrich and expand research-based educational materials, outreach, and engagement activities to spread awareness about this framework to communities and workers. To achieve these goals, this multidisciplinary project blends research linking eye movements and workers' attention with research focused on working-memory load and decision making in order to discover how and why workers in dynamic work environments fail to detect, comprehend, and/or respond to physical risks. Using the dynamic and high-risk environment of construction as a testbed, the proposed framework will connect eye movements and cognitive manipulations in laboratory and field experiments with worker demographics to identify precursors that predict accident-causing human errors in dynamic worksites. In all, this project will demonstrate the value and effectiveness of synthesizing cognitive psychology, engineering, and advanced computation to improve decision-making and occupational safety.

The Human-Error Detection Framework will harness real-time eye-movement patterns to identify human errors and thereby lay the foundation for synthesizing technology with data analysis to automatically identify and interrupt human decision-making errors before injuries occur. Using the predictive models resulting from this study will not only contribute to significant accident reduction but will also provide a critical validation measure to confirm the effectiveness of training programs in enhancing workers' risk-analysis skills. Furthermore, since this project provides tools and insights for researchers, students, and workers to use to enhance occupational safety and multidisciplinary research, this project will evolve the broader pedagogical landscape of the decision, risk, and management sector. As this innovative research challenges the conventional, reactionary paradigm of safety-risk management by enabling the identification of at-risk workers using a measurable indicator of their cognitive processes, i.e., their eye movements, the proposed proactive approach to occupational safety has the potential for averting occupational accidents across industries and thereby will foreseeably prevent the

injuries that undermine the well-being of millions of American workers and their families.

Keywords
Human Error; Situation Awareness; Wearable Technologies.

Biography
Dr. Behzad Esmaeili is an Assistant Professor at the George Mason University's Sid and Reva Dewberry Department of Civil, Environmental, and Infrastructure Engineering. He actively conducts research in the field of construction safety, specializing in injury prevention strategies, hazard identification, risk management, and decision making. His research on construction safety has been nationally and internationally recognized more than once, most notably in the 2014 Prize Award for Innovation "Jaume Blasco," 18th International Congress on Project Management and Engineering (ICPME), New Scholar award from the Construction Industry Institute in 2014, Best Paper Award from the Construction Research Congress in 2016, Best Academic Award from the Construction Industry Institute in 2016, and the Best Paper Award from ASCE Journal of Management in Engineering 2018. Dr. Esmaeili actively serves on the Construction Industry Institute's Safety Community of Business Advancement (CII SCBA) and AFH10 committee at Transportation Research Board (TRB).

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Preparing Engineers to approach Complex Global Challenges from a Socio-Technical Perspective

Jan DeWaters[1]

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Abstract

Engineering graduates must be prepared to address complex, global challenges, whose solutions will be necessary to ensure sustainability of the planet and its inhabitants. Problems related to global energy and climate issues are paramount. Global energy challenges intersect with several of the 17 United Nations Sustainable Development goals established in 2015. Indeed, a sustainable future will require the development of clean, renewable energy resources that are distributed equitably among the world's populations, as well as methods to improve efficiency of energy use.

Solutions to such complex challenges will require engineers to consider the broad spectrum of interrelated consequences including human and environmental health, sociopolitical, and economic factors. In addition to a strong technical foundation, engineering students need to acquire an understanding of social and humanistic aspects of their work, and to develop multidisciplinary teamwork skills. To that end, an effective education program will use a systems-based approach to integrate multiple perspectives from a socio-technical frame of reference, contextualizing the technical issues within the larger, more complex social, economic, and environmental challenges.

Teaching engineering students about energy issues in a societal context, simultaneous with developing the depth of their technical knowledge and skills, will better prepare them for engaging in real world problem solving. In addition, preparing engineering students to engage in collaborative problem solving requires a paradigm shift that is also characterized by immersive, collaborative educational strategies that use democratized decision making, creative inquiry, reflection, and iterative learning. These strategies support and engage different types of learners and are widely shown to develop critical thinking, communication, and problem-solving skills, extending beyond knowledge formation to challenge students' values.

This presentation will include a general introduction to these ideas for a broad, socio-technical approach toward engineering education, and will discuss in detail an introductory energy course that approaches energy education from a socio-technical perspective, emphasizing the complex interactions of energy technologies with sustainability dimensions.

Keywords

Engineering Education; Sustainability; Energy

Biography

Jan DeWaters is an Associate Professor at Clarkson University in Potsdam, NY, USA, with a joint appointment in the Institute for STEM Education and the Wallace H. Coulter School of Engineering. Her research involves the implementation and evaluation of evidence-based pedagogies in STEM education. She has developed and applied quantitative and qualitative measures of energy literacy to help us understand how energy education can improve energy literacy among pre-college students and young adults. Her energy literacy questionnaire has been adapted for use in over 60 different research and education settings in 12 countries around the globe. She has published and presented her work at a number of national and international conferences and peer-reviewed journals, and is a recent recipient of the Women in Engineering Division of the American Society for Engineering Education's EEEG award, an early career award that celebrates strong leadership and support for female and minority engineering students.

Dr. DeWaters teaches introductory-level engineering courses in Clarkson's first year program and, more broadly, courses about energy issues and energy systems. Her approach to teaching these introductory courses is to expose students to the complex relationship between the technological work of engineers and technical professionals, and the social and natural environments in which those technologies are used. Using a human-centered, socio-technical approach to engineering education, she seeks to develop students' skills to work effectively in interdisciplinary teams and approach problems from multiple perspectives so they are better prepared to contribute toward global engineering challenges in the future.

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Exploring Timber Building Systems for Deployable Relief Structures: Modular and Kit-of-Parts Solutions

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Abstract

According to the United States Federal Emergency Management Agency (FEMA) 2017 Hurricane Season After-action Report, FEMA provided 2.7 million hotel nights to almost 60,000 households with Transitional Sheltering Assistance (e.g., hotel rooms) by November 30, 2017, and this number had increased to about 5.3 million by May 1, 2018. These short-term sheltering programs last significantly longer than their designed duration, highlighting the need to establish a more effective post-disaster direct housing plan that can handle large-scale disasters like catastrophic hurricanes. Direct-housing solutions are considered the last resort for temporary housing and the direct-housing plan is activated after other housing assistance options (such as rental assistance and temporary lodging in local hotels) are exhausted due to their high logistical cost and financial complications.

In the United States, there are many different possible approaches to post-disaster direct-housing systems, and there is not a one-size-fits-all" solution. This is due to wide variations in disaster scenarios (hurricane's landfall location, severity, timing, etc.), logistical protocols, and the intent and timeline for the housing itself. Too often, the attributes that are desirable for direct temporary housing (speed and ease of delivery and setup, low labor and power requirements, etc.) are at odds with the durability, resiliency, energy performance, spaciousness, and other cultural expectations associated with permanent housing. Temporary MHUs of the past, such as those supplied by FEMA after Hurricane Katrina, are illustrative of these limitations. Alternative housing solutions that exhibit promising logistics attributes, such as rapid deployability, low cost, high modularity, etc., have potentials to serve as an adaptable solution from temporary to permanent housing. Such "temporary to permanent" models can serve as the short-term housing solutions in the first few weeks or months in immediate disaster response, while serving as the basis for permanent housing through incremental growth as the community and households phase into the disaster recovery process. This notion is captured by concepts such as progressive shelters (post disaster rapid household shelters planned and designed to be later upgraded to a more permanent status) and core shelters (post disaster household shelters planned and designed as permanent dwellings, to be the part of future permanent housing), as defined by the International Federation of Red Cross and Red Crescent Societies. Recent examples of this thinking include the RAPIDO housing project from BC Workshop, which features an expandable core dwelling unit. Building upon such concepts, ongoing research at Clemson University targets novel direct housing solutions with prefabricated timber structural systems, ranging from cross-laminated timber modules produced and assembled offsite, to flat-packing, kit-of-parts framing with interlocking plywood componentry. The kit-of-parts system employed for this study has been developed at Clemson over the last eight years, and

has been utilized for a range of small buildings and demonstration structures across North America and in Europe.

Keywords
Disaster Recovery; Modular Building Systems; Timber.

Biography
Dustin Albright is an Associate Professor and Assistant Director in the School of Architecture at Clemson University, in the United States. In both teaching and research, he draws from his dual expertise in architectural design and structural engineering. He is a founding faculty fellow in Clemson's Wood Utilization + Design Institute, and his research revolves around prefabricated timber building systems at varying scales, from innovative light framing systems to mass timber design and construction. From 2019-2021 he served on the board of directors of the Building Technology Educators' Society (BTES). He is also a licensed and practicing architect, acting as a project designer and mass timber consultant with Hanbury, a regional firm in the southeastern United States.

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Development of Solid-Fluid Coupling Simulation Technique and its Applications to a Chain of Geo-Disasters Initiated from Landslides

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Abstract

A strong earthquake or a heavy rainfall can induce a large number of landslides. A large-scale landslide can create a landslide dam when falling sediments stop a river. Because of its rather loose nature and absence of controlled spillway, a landslide dam is easy to fail and lead to debris flow or downstream flooding. Also, since the landslide sediments can be removed into a valley or a ravine by excessive precipitation, which can lead to a debris flow. These secondary disasters ocuur as a chain of geo-disasters initiated from landslides. In order to clarify the mechanisms and evaluate risks of these geo-hazards, we have developed a series of numerical simulation techniques based on discontinuous deformation analysis (DDA) by coupling it with smoothed particle hydrodynamics (SPH). In this presentation, developments and applications of the following numerical simulation techniques will be introduced and some key issues will be discussed based on the results obtained from simulations: 1) a simulation technique for earthquake-induced landslide using DDA; 2) a simulation technique for rainfall-induced landslide using DDA based on matric suction; 3) a simulation technique for soil-rock slope and structure using DDA coupled with SPH of soil particles; 4) a simulation technique for debris flow with large rock and wood using DDA coupled with general debris flow simulation (DFS); 5) a simulation technique for landslide-dam formation and collapse using DDA coupled with SPH of water particles..

Keywords

Landslides; Earthquake; Numerical simulation; DDA.

Biography

Prof. Guangqi CHEN is currently both a Professor of Faculty of Arts and Science and a Professor of Department of Civil and Structural Engineering, Graduate School of Engineering, Kyushu University, Japan. He received a Doctoral Degree of Science from the University of Tokyo in 1993 and worked as a lecturer at the Department of Civil Engineering of Kyoto University before transferred to Kyushu University in 2000. His research background includes geophysics, seismology, plate technics, earthquake engineering, geo-disaster prevention, numerical simulation and risk management.

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Soil Liquefaction Phenomena and its Impact on Marine Structures

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Abstract

In nature, granular soils' behavior under different types of loading includes numerous and complex phenomena. Saturated granular soils consist of the soil skeleton, the pores of which are typically filled with water. The structure behaves like a solid body because of inter-granular forces. However, sometimes (under special conditions such as influence of earthquake or impact loading) the increase of pore water pressure is observed. It may lead to a decrease in inter-granular forces (effective stresses). In an extreme case the saturated soil may behave like a liquid. This phenomenon is called soil liquefaction. When this situation occurs, correct assessment of conditions is crucial for planning/designing a safe process for construction and exploitation of marine structure. Liquefaction of the seabed leads to various catastrophic events, such as the sinking of structures in a liquefied subsoil and others.

This paper consists of a few parts. Firstly, as an introduction to the subject, selected cases regarding the impact of soil liquefaction on behaviour of different types of engineering structures are discussed. The main conclusions resulting from the analysis of case-studies are presented. Then, the information regarding the scope of tests/research program that should be performed to recognize the liquefaction potential of specific soil is pointed. In the next part, the results of laboratory investigations of physical and mechanical properties of the selected soil samples are presented. They were performed using triaxial apparatus for samples characterized by different initial relative density (loose, medium-dense and dense soil samples were investigated) and various initial values of average effective stresses. Typical obtained results are presented. The tests were carried out in undrained and drained conditions at different initial void ratios and mean effective stress. The monotonic liquefaction potential of investigated samples has been estimated by determining the steady state line and zone of contractive behavior of soil during shearing. Additionally, the behavior of soil under cyclic loading programme was also monitored. Main conclusions from the performed experimental programme are presented. The information regarding soil susceptibility is summarized. Conditions influencing liquefaction are discussed. Findings important from the practical point of view are pointed out. In the last part of the paper, a theoretical approach to modelling liquefaction behaviour of seabed is proposed. It is a presentation of a systematic approach to the analysis of liquefaction susceptibility of soils in seismic areas based on the compaction/liquefaction model. This model is briefly outlined, then respective experimental procedures dealing with its calibration are described, and values of material parameters are listed. Discussion of some standard empirical procedures of estimation of liquefaction potential of saturated soils, conducted from the analytical point

of view, is also presented.

Keywords
Soil liquefaction; Pore water pressure, Granular soil, Soil parameters

Biography
Krystyna Kazimierowicz-Frankowska, MSc, PhD, DSc, Associate Professor and Deputy Head in the Department of Geomechanics of the Institute of Hydro-Engineering of the Polish Academy of Sciences. Author and co-author of some 70 publications, including 4 books on applied mechanics, mechanics of reinforced soil, geosynthetics, and civil and marine engineering. Her research interests are focused on both basic and applied research on modelling the mechanical behavior of geomaterials, as well as phenomena and processes in subsoil in connection with the problems of soil-structure-water interactions. Her latest books are: “Geotechnical Aspects of Multi-use Offshore Platforms” 2015, “Geosynthetics in Hydraulic Engineering”, 2019. Currently, she takes part (as the Head of the Research Team on behalf of the Polish consortium member) in the realization of the project NuLIMAS aiming at the development of an open-source numerical modelling framework for liquefaction around marine structures, which can reproduce the most salient physical processes with a reliable level of accuracy. NuLIMAS receives funding through the ERA-NET Cofund MarTERA (Grant No. 728053) in the H2020 framework.

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Artificial Headlands to Prevent Beach Erosion on Misawa Coast, JAPAN

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Abstract

1. Objectives

There was a beautiful and long sandy beach in Misawa city, Aomori prefecture, Japan. However, after a fishery port was constructed on the sandy beach in 1971, severe beach erosion hasoccurredon the Misawa coast. Some sandy beaches of 500m width disappeared along the coast. Aomori prefecture has been constructing the artificial headlands along suitable lengthsof the coast from 1991 to 2020. The aim of the construction for the artificial headlands is to prevent beach erosion and to create a stable state on the coasts between the artificial headlands. Sasaki, Takeuchi and Fujita 2000 [1] have shown the beach deformation before and after the construction of the artificial headlands from 1987 to 1999. In addition, Sasaki, Takeuchi and Fujita 2002 [2] have shown the characteristics of the shoreline changes from 1999 to 2001 by using GPS. They have shown that the shoreline changes inyearly cycleswhich advances in May to July, and retreats in winter, and that the position of the averaged shoreline changes within 40m. Sasaki, Takeuchi, Fujita and Ogasawara 2004 [3] have shown the characteristics of the shoreline changes from 1987 to 2003. Sasaki and Takeuchi2014 [4] have shown that the shoreline along the coasts between the artificial headlands from B1 to B9 have recovered to the position of the 1990 shoreline, and that, however, the retreat of the shoreline along the coasts between the headlands from B10 to B13 have still continued due to the delay of the construction of the artificial headlands.

The construction of the artificial headlands has been completed in 2020. In this study, using the results of thefield observation, the beach deformation after constructing artificial headlands has been investigated. The present study has shown the characteristics of the geographical sea bottom changes for 20 years from 2000 to 2020.

2. Methods

Photographs have been taken to investigate the beach deformation in the north coast of the fishery port. The field observation for the shoreline has continued by walking about 14 km along the coasts between the artificial headlands from B1 to B14 once a month since 1991. A GPS measuring-machine and a small personal computer have been used in the observation since 2000.

3. Results and Conclusions

The shoreline changes were investigated in the present study to make clear the characteristics of the sea bottom topographic changes in long term for several years. The beach erosion is not occurring now on the north Misawa coastbecause of the construction of the artificial headlands. The effects of the countermeasures by using a group of the artificial headlands for the beach erosion have been clearlydemonstrated on Misawa's coast. The artificial headland method for the beach erosion is effective onsandy beaches in other country.

Keywords

Artificial Headland; Beach Erosion; Coastal Sediment; Sandy beach

Biography

Mikio Sasaki is a professor emeritus at Hachinohe Institute of Technology, Japan. He has been primarily concerned with the research fields on hydraulics, hydraulic engineering, coastal engineering and river engineering. He performed energetic researches on problems relating to nearshore currents, wave deformation, coastal sediment, hydrology, snow-water mixture flows, snow dynamics and physical properties of snow. He has been announcing a lot of papers in these research fields.

Takahiro Takeuchi is a professor at Hachinohe Institute of Technology, Japan. He has been primarily concerned with the research fields on hydraulic engineering, coastal engineering and ocean engineering especially relating to cold regions. He performed energetic researches on damage to coastal and offshore structures by moving ice, and interaction between driftage and structure under impact of Tsunami in ice-infested sea. He has been announcing a lot of papers in these research fields.

On the Accuracy of Piezoelectric Vibration Energy Harvesting Modeling

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Abstract
Piezoelectric direct effect is widely adapted in energy harvesting and scavenging applications. Strain and stress based piezoelectric energy generations are also fundamental and common studies due to its huge contribution in wide range of areas from micro systems to aerospace. Piezoelectric effect is modeled through four constitutive sets of linear equations, nonlinear behavior of piezoelectricity and especially depending on nonlinear shape effects of plates challenge researchers to model piezoelectric power output under base excitation input. To begin with, well known Hehn and Manoli's commonly referred maximum extractable power output formulation is covered and corrected model is proposed (pioneer proposal 1). Secondly, specific to vibration energy harvesting applications the most accurate model is based on the initial studies of du Toit and Erturk. In the light of du Toit amplification factor and by improving Erturk's mass correction factor, unique contribution on damping correction factor is proposed for more accurate estimation (pioneer proposal 2). Experiments are performed with commercial beam shape piezoelectric transducers at resonance frequencies and modal frequencies. Regarding the commercial piezoelectric transducers, relative piezoelectric constants as well as lumped element parameters are further used for estimation of both existed and proposed modeling. It is further presented that the upgraded third level correction on damping factor resulted maximum output power error of 5%. While the estimated power output error of du Toit is subject to vary broadly, Erturk's contribution resulted minimum error of 15%. Moreover, in this research, suggested pioneer proposal 2 results in the minimum error of 1% for power output of commercial piezoelectric transducer. Though exact error band depends on the number of experiments covering wide range of vibration frequency and amplitude cases together with optimum loads, conducted study indicates that the error mostly lies in 1% band and rarely reaches up to 5% in comparison with measured power outputs.

Keywords
Piezoelectricity; Vibration Energy Harvesting; Piezoelectric Power Generation; Maximum Extractable Power Estimation.

Biography
Nazenin Gure, Research Assistant in Beykent University, Istanbul, TURKEY and CEO of ENHAS R&D Energy Systems Limited Co., Istanbul, TURKEY.

She is Research Assistant in Department of Mechanical Engineering in Beykent University, TR. Her B.Sc. is in Environmental Engineering, B.Sc and M.Sc in Mechanical Engineering.

She is a PhD. candidate in Electrical and Electronics Engineering Department in Marmara University, TR. Her scholarship is supported by Scientific and Technological Research Council of Turkey. Her start-up project is selected for Technological Entrepreneurship Industry Support (TGSD), funded by Republic of Turkey's Ministry of Science, Industry, and Technology (MoSIT). Her M.Sc. Thesis on Energy Harvesting is published by USA's leading piezoelectric company: Mide Technology and PIEZO. As a CTO of ENLIL project is awarded with International Theme Award in Climate Launchpad, Edinburg, UK (2018: Urban Transitions Award Winner). She has 5 National Awards in which belongs to 3 different Blockchain Projects. Finally, MNG KARGO ApiZone Hackathon Finalist for Blockchain logistic solution). She participated hackathons such as MIT Beat The Pandemic II, EUvsVirus Pan-European, Florida Sunshine Hackathon and Facebook F8 Refresh. She is the lead inventor of two awaiting patent applications. Her recent studies are presented in Silicon Valley, CA, USA in IEECP'21 and Osaka, Japan, Science Federation in Infrastructure Construction 2021.

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Sensor Systems for Timber Building Monitoring

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Abstract

Number of high rise timber buildings is growing in EU as well as other parts of the world. Codes and standards are covering mainly limitations in terms of the fire resistance and static design. Statistics of property insurance claims shows that the number of problems caused by moisture and water is higher then the number of problems caused by fire. For example, insurance claims in UK stated that escape of water causes 29% of insurance claims while the fire causes only 17%. Monitoring of timber structures is mandatory and not supported by any standard or directive in EU. Fire resistance of timber elements and materials is fully covered by national or EU standardization.

Monitoring of conditions in inaccessible parts of timber structures is a key for fast detection of any increased risk caused by high humidity or moisture levels. Miniaturization of sensors and reduction of the price enabled application of technologies for integrated monitoring systems directly into the timber structure and monitor the conditions for many years or for the whole life cycle of a building. Mathematical models were developed processing data from measured temperature, relative humidity and material moisture to indexes representing the risk of mould or fungi infestation or wood decay.

These models can be used to predict mould growth and reliably detect potential problems in the timber structures.

Even if the most of the models were verified under laboratory conditions their real applicability for timber building monitoring is still under discussion. The comparison of several wood decay and mould growth models will be presented in this work on datasets from real timber buildings and the usability discussed. The most common problems related to the increase moisture or humidity in the timber structures will be presented together with typical patterns of the data taken from the timber structure related to these problems.

Keywords

Timber structures, moisture, sensor systems

Biography

Jan Včelák, Ing., Ph.D., researcher in InnoRenew CoE and in CTU-UCEEB, in period 2014-2019 department head in CTU - University Centre for Energy Efficient Buildings, department for monitoring and intelligent control and lecturer on CTU. Got his Ph.D. in 2007 on CTU Faculty of electrical engineering. His expertise is mainly in sensor networks design including IoT and WSN, sensor design for special purposes, and complex sensor systems covering data acquisition, transmission, processing and presentation. As a postdoc researcher, he was a team

leader in microsystems group in Tyndall NI (Cork, Ireland). From 2014 is focusing on sensors for timber structures monitoring. He is inventor of MoistureGuard system for wood moisture monitoring and co-founder of the company with the same name. His tasks at CTU are mainly in coordination of R&D activities and project management while in InnoRenew is focused on new sensor system development and applications within ICT group. He is principal investigator and coordinator of several national and international research projects in the field of IoT sensor design and renewable energy sources. He is author of several impacted publications, patents and utility models in Czech Republic and US.

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Innovative Thermal Systems for Building Applications

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Abstract

Air conditioning is essential to sustain thermal comfort for both indoor and outdoor environments, particularly for hot and humid climates. Other needs of a building include heating, and potable water. In tropical climates, due to extreme amount of water vapour in the atmosphere, the energy consumed by heating, ventilation and air-conditioning (HVAC) often exceed 50% of the total energy consumption of a building. This significant figure imposed on present vapour compression air conditioners to remove both sensible and latent heat loads. Accordingly, there is tremendous potential to improve the overall efficiency of the air-conditioning by decoupling sensible and latent cooling as well as designing innovative thermal systems to support other needs. This talk primarily focuses on recent development of several innovative cooling/ dehumidification technologies and strategies when implemented correctly will markedly improve the energy efficiency of air conditioning in buildings. Additionally, it also looked at the innovative design and engineering of a thermally-driven system that provides other useful utilities, namely, electricity, heated water, potable drinking water.

Keywords

Air Conditioning, Dehumidification, Building Efficiency, Thermal Energy

Biography

Dr Chua Kian Jon is currently an Associate Professor with the Department of Mechanical Engineering, National University of Singapore. He has been conducting research on air-conditioning, refrigeration, and heat recovery systems since 1997. He has conducted both modelling and experimental works for specific thermal energy systems. These include dehumidification, cooling, heat pumping, compact heat exchangers and refined temperature/ humidity control. He is highly skilled in designing; fabricating; commissioning and testing many sustainable energy systems to provide for heating, cooling and humidity control for both small and large scale applications. He has more than 200 international peer-reviewed journal publications, 6 book chapters and two recent monographs on advances in air conditioning (https://www.springer.com/gp/book/9789811584763 and https://www.springer.com/gp/book/9783030808426). He was highlighted to be among the top 2% of global energy scientists based on Elsevier's database, 1% of scientists in the world by the Universal Scientific Education and Research Network, top 0.3% in the Stanford list of energy researchers. He has been elected to several fellowships including Fellow of Royal Society, Fellow of IMechE and Fellow of Energy Institute. His works has garnered more than 11,400 over citations with a current h-index of 56. Further, he owns more than 15 patents related to several innovative

cooling and dehumidification systems. He is the Principal Investigator of several multi-million competitive research grants. Additionally, he has been awarded multiple local, regional, and international awards for his breakthrough research endeavours.

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New Research Achievement on Environment-Friendly Concrete

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Abstract

Faced with environmental issues such as global warming, China has proposed to strive to have carbon emissions peak by 2030 and achieve carbon neutrality by 2060. As a global common thorny issue, large-scale recycling of solid waste is an important way to achieve carbon neutrality. Among various solid wastes, the problems of construction waste and discarded synthetic polymer materials are the most prominent. Rubber particle-steel fiber-recycled aggregate concrete (RSRAC) is a new type of recycled environmental protection high-performance concrete based on the recycling of waste concrete and tire rubber and using their special properties to improve the mechanical properties of concrete. In this presentation, four-point bending tests are carried out on four kinds of concrete specimens with the mixed combination of rubber particle, steel fiber, recycled aggregate and natural aggregate, so as to reveal the damage mechanism of RSRAC. Crack detection and damage evaluation of rubber particle-steel fiber-recycled aggregate concrete based on acoustic emission technique was also employed during the study. This study can provide a reference for engineering application of RSRAC.

Keywords

Carbon emissions; Environment-Friendly; Rubber particle-steel fiber-recycled aggregate concrete; Acoustic Emission

Biography

Dr Jie Xu is professor at Tianjin University. He received his M.S. from Tianjin University in 2008 and obtained PhD from Politecnico di Torino, Italy, in 2012. He is the chief engineer of civil engineering testing center and deputy director of bridge and structural engineering laboratory of Tianjin University. His research mainly focuses on structural health monitoring, ultra-high performance material and new technique and new system. He has published 3 technical books and also published about 100 technical papers. He has also been a reviewer for more than ten high level international scientific journals, such as CACIE, SHM, CBM and so on. His research result has been applied in many important projects and he has been awarded several awards for both research and teaching.

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DEM Investigation on Creep Behaviour of Granular Soils

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Hong Kong, China

Abstract

Particle-scale mechanisms that control the static creep behaviour of sands are not well understood. In this context, this study examines the problem of creep of crushable sands undergoing 1D compression and triaxial shearing using 3D DEM simulation. The rate process theory (RPT) based creep contact model considering rolling resistance and a probabilistic particle fracture model satisfying mass conservation are incorporated into a large-scale DEM simulation. The coupled effects of the interparticle sliding and delayed particle fracture, and the influences of rolling resistance, initial porosity and characteristic particle strength on the creep behaviour are then investigated. The high capabilities of the model in reproducing many facets of the soil behaviour during the 1D compression and triaxial creep seen in the laboratory is demonstrated by comparing the simulation results with published experimental data. It is found that the creep deformation is mainly caused by stress redistribution at low vertical stress while particle rearrangement and particle breakage becomes more prevailing with the increase of vertical stress.

Keywords

Creep; Granular materials; DEM; Rate process theory

Biography

Dr. Wang is currently an Associate Professor at the Department of Architecture and Civil Engineering at City University of Hong Kong. Dr. Wang is an internationally recognized expert in the field of X-ray micro-computed tomography (micro-CT) characterization and discrete element method (DEM) modeling of granular soils. Dr. Wang's work has been awarded the prestigious international prizes of 2011 Geotechnical Research Medal (UK Institution of Civil Engineers) and 2010 Higher Education Institutions Outstanding Research Award - Natural Science Award (the Ministry of Education of China). He has delivered a number of keynote and invited lectures in reputable international and domestic conferences, workshops and seminars. Dr. Wang' research has attracted over 7 million HKD of external grants including the Research Grant Council (RGC) of Hong Kong SAR and National Science Foundation of China (NSFC). Dr. Wang currently serves as an Editorial Board Member of 4 top international journals in geotechnical engineering including Géotechnique (Associate Editior), Computers and Geotechnics, Journal of Rock Mechanics and Geotechnical Engineering, and Soils and Foundations. So far Dr. Wang has published over 140 peer-reviewed articles with a Google Scholar H-index of 28.

The Lubrication Layer in Concrete and Its Rheological Properties

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Abstract

Flow induced particle migration facilitates the formation of lubrication layer, which dominates the pumpability of concrete. Although, the theory of flow induced particle migration has matured. Limited study in simulation of concrete pumping utilizing particle migration. Most numerical works are based on computational fluid dynamics(CFD) model, which simplifies the concrete as two discrete parts, concrete bulk and lubrication layer, with constant rheological properties which deviates from the real physical model. And the wall effects on the concrete are often neglected. Our research found that diffusive flux models (DFM) of particle migration in non-Newtonian suspensions can be extended to account for the wall effect and simulate the concrete flow under pumping more accurately. The observations of the model illustrate that the wall effect has vital influence on the formation of lubrication layer, as well as the shear rate. After particle migration, lubrication layer is nearly barren of aggregate, but enriches in sand. In spite of the similar composition, experimental and numerical comparative results prove that the rheological properties of lubrication layer are not necessarily equal to those of mortar, which differs from the assumption in most CFD models. Besides lubrication layer, the local rheological properties near the wall are also found to be influenced by particle migration.

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Actual Situation about Effectiveness of the Diversity in Urban Improvement -from the Point of View of Population Aging

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Abstract

Japan has been facing problems related to decline of population and aging. Also Tokyo metropolitan area is under population aging. But, at some districts, the aging is slow. On the other hand, urban diversity is the key concept at urban planning. I study Tokyo metropolitan suburban area from the point of view of population aging and its relationship to diversity of housing such as detached house, apartment and condominium, and to diversity of land use such as low-rise housing, crowd low-rise housing, middle and high-rise housing, commercial and business use, park and green land, manufacturing, public institution and development land and so on. The study analyzed population aging according to 7333 subregions of Tokyo metropolitan area at 2010 and 2015. In addition, I survey characteristic districts. As a result the following points were demonstrated.

A. aging population component at metropolitan area is distributed between 0.1% and 71%, and its average is almost 25 % at 2015.

B. The district with many elderly people spreads out widely from the center to the suburbs.

C. Aging population component is low in the suburban sprawl districts, where include variety land use.

D. low-rise suburban sprawl districts are generally high aging population component.

E. Diversity of housing and land use is effective to aging moderation.

F. The aging rate is generally high in the planned low-rise housing development districts. However, the district, where aging is slow, exists in such an area. In such districts following factors are effective.

1) Maintenance of enough large scale lots in the low-rise housing district for three generations living together.

2) Public child care support for the family household during child care such as nursery school enlargement, Improvement of correspondence to an illness child and enhancement of child-care consultation service, etc.

3) Rental type public housing.

4) Not a collective sale in lots, but sale the fixed-quantity by constant a year in lots.

Keywords

Effectiveness of the Diversity ; Aging ; Tokyo metropolitan area

Biography

Takashi Nakamura: Associate professor, Department of Civil & Urban engineering, Tokyo City University, Tokyo, Japan, covering city planning, infrastructure design, urban and regional analysis, studying land use planning system, local cities central area revitalization, TOD, and nationwide planning.

From 1995 to 1996 experienced an Academic Visitor of the Bartlett School of Planning, University College London, London University.

From 1992 assigned at Tokyo City University as a Lecturer and Associate Professor.

- received a Doctor of engineering from Tokyo University in 1991.
- worked at National Land Agency, Prime Minister's office, that covered nationwide planning, land use planning, disaster prevention and regional planning for 8 years from 1980 to 1992.

Graduate from Tokyo University at 1980.

Birth in Japan at 1958.

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Practical Research and Local Government Collaboration

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Abstract

This presentation is based on five years Japan and Indian joint research activities and introduces important aspect for reaching practical solution for urban transportation in developing countries. From our history, transportation is always one of issue for quality of civil life and challenges under limited several conditions such as unbalanced between large demand of transport under rapid economic growth and limited infrastructure improvement. During the current five year research from April 2017 to now, we have several important experiences which might be good reference for on-going transportation challenges in the world.

At first, we achieved traffic condition visualization more than two years observation in one of major city in India—Ahmedabad city in Gujarat state of India, where locates at the west side of Indian continent and its population is about 8 million in 2020. There is no exception about heavy traffic congestion these days. For collecting traffic information, we use the current existing traffic monitoring cameras which has been installed 30 location in the west side of Ahmedabad city, which is called “New City” because of new expand residential buildings, shops, and offices. The traffic data consist of number of vehicle per hour and kilometre, average vehicle speed, vehicle occupancy ration etc. They are also none of new. But once, they are integrated and mapping by GIS or geographical information system tool such as ArcGISTM, it shows clearly each time frame traffic condition where and when most congested or not. In order to analysis these traffic congestion, we need to have some modelling about the traffic.

The second point of understanding for the traffic condition is modelling based on the collected data. Here is important thing for modelling. It is well-know that traffic analysis original comes from fluid flow mechanism theory such as Greenshields early 1930s. After the first traffic flow model shows, there are many researchers and road operators who have studied and introduced their papers. There are many informative research result and papers, but they are not enough to providing actual solution. In our research, we focus on observation data and then try to create model with the traffic theory. In this stage, we carefully put the data result priority and then make feedback to the theory. There are sometimes situation to change theoretical equation to fit its observation data but we try to minimize these risk. Therefore, it is able to keep theoretical equation and find out appropriate model.

The third point is to generate strong collaboration and more communication with the local government based on the comparison between the actual issues and research result. Sometimes we find real problem and or reason why these issues come. This point is the most important

to solve the issues or at least to reach the fundamental issue from the collaboration. We share some of experience during our research activities to compare the real issue and its theory—traffic flow and fluid flow mechanism, traffic policy and traffic fatality Smeed's law, and traffic congestion and Shock Wave theory.

Keywords
Urban transportation; Traffic Flow mechanism; Traffic accident; Traffic congestion.

Biography
Tsutomu Tsuboi joined Hitachi from 1979 and worked as industrial motors designer until 1985, then Network product management of Semiconductor Div. from 1986 to 1997. He use was manager of Hitachi Semiconductor America Inc. from 1997 to 2000. He was senior manager of Renesas Technology from 2003 to 2010. He was senior manager of Smart City Div. of Hitachi Ltd. from 2010 to 2012. He was Project Director of Hamamatsu Agency for Innovation from 2012 to 2014. He is currently general manager of Global Business Development office in Nagoya Electric Works since 2014. He is principal researcher for government funded project "SATREPS" Science and Technology Research Partnership for Sustainable Development for Low Carbon Urban Transportation Design in India from 2016 to now. He is IPSJ (Information Processing Society of Japan) member and IEEE (Institute of Electrical and Electronics Engineers) senior member.
Education: Ph.D. Aichi Prefectural University, April 2014-March 2017 Information and Science Technology for Wireless Access Vehicle Environment and Networking Technology. Master, The University of Tokyo, October 2010-September 2012 Sustainable Urban Regeneration Program.

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Cable Congestion in Hospital Ceilings and the Smart Age-A Caution about Paying Careful Attention to Things That Can't Be Readily Observed

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Abstract

Hospital buildings are extremely complex, with patient rooms, consultation rooms, examination rooms, treatment rooms, operating rooms, and nurse and doctor's rooms necessary for the primary medical functions. Supporting these are storage rooms for materials and medicines, sterilization and food service facilities, staff offices, conference rooms, and locker rooms. All must be equipped with electricity and air conditioning. Medical gas lines must be installed in rooms for serious patients and operating rooms. With advances in technology, wiring for nurse call systems, the antennas of medical telemetry systems, and that related to wireless LANs, have become essential. This complex environment must be carefully planned and implemented. Unlike in stores and offices, the wiring and piping tends to be placed in walls and ceilings so that it is not visible in corridors and hospital rooms. This is partly for aesthetic reasons, but also because of patient safety, a top hospital priority, by preventing falls and injuries caused by exposed wiring.

In Japan, and most likely many other countries, the design and installation of communication cable, wiring, and equipment, including ICT-related equipment, is often left until the final stages of construction, especially in large hospitals. This is because they are treated as equipment, not as an integral part of the facilities. Because the amount and location of the required wiring is often not considered during the basic design and construction stages, extremely congested ceilings and difficult situations for wiring management can become problematic, causing major problems in hospital maintenance and the renovation of older buildings.

Hospitals are increasingly using wireless communication, and the antennas (access points in the case of wireless LAN) and wiring to connect routers to antennas are generally installed in the ceiling. This poses not only the problem of congestion but also the necessity of carefully designing and controlling the radio wave environment. It is important to protect against things that impact the quality of the radio waves, such as metal ducts for air-conditioning, which can reflect signals, and cables with high current, which can induce magnetic fields. Leaky co-axial cables (LCXs) are sometimes used as an antenna in wireless LAN and medical wireless telemetry systems, and it is important that they be kept away from metal. This can be difficult in a congested ceiling that has many metal components and fixtures.

To realize a "smart" hospital, the environment for communication, especially wireless communication, must be carefully managed. In this presentation, I will discuss the wiring of hospitals, focusing on the ceiling and mainly from the viewpoint of communication facilities.

Keywords

Hospital building; ICT; Cabling; Wireless communication

Biography

Eisuke Hanada was born in Tokyo, Japan, in 1963. He received his B.Eng. and M. Eng. degrees from Kyushu University, Fukuoka, Japan, in 1985 and 1987, respectively. He received his D.Eng. degree from Saga University, Saga, Japan, in 2001. Prof. Hanada has been working in the Department of Information Science, Saga University Faculty of Science and Engineering since Oct. 2014. He previously worked at the Nagasaki University Information Science Centre (1992-1996), at the Department of Medical Information Science, Kyushu University Graduate School of Medical Science (1996-2002), and at the Division of Medical Informatics, Shimane University Hospital as vice director (2002-2014). His research involves the wired/radio communication environment, EMC of medical devices, hospital information systems, ICT/ IoT systems in clinical settings, AI use for medical staff, and telemedicine. He was involved in remodelling of both Kyushu University Hospital and Shimane University Hospital. Prof. Hanada is a member of the Japanese Society of Medical Informatics, the Information Processing Society of Japan, the Japanese Society of Medical and Biomedical Engineering, the Healthcare Engineering Association of Japan (a board member), and the Acoustical Society of Japan.

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Strategies for Smart and Sustainable Transport from a Gender Perspective

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Abstract

Mobility, and especially urban mobility, has changed drastically in recent times. This has been due, on the one hand, to the development and application of new technologies that have led to new modes of transport, fuels and resource sharing. On the other hand, the impact on mobility and logistics of the COVID-19 pandemic crisis, which has led to a decrease in the number of daily trips, changes in the choice and use of transport modes and the accelerated evolution of B2C e-commerce logistics distribution.

Gender differences in mobility patterns are well known. Although the geographical, social and cultural context may influence mobility habits, and may make these gender differences more or less pronounced, the literature published over the years has identified common patterns or trends in developed countries. On the other hand, the effects of the COVID-19 crisis in the social and economic sphere have aggravated inequalities between population groups, with women being one of the most affected groups, which may accentuate this gender gap in mobility.

Mobility and transport policies should aim at an efficient and sustainable use of transport modes, while ensuring road safety and equal opportunities of use.
Through a strategic analysis of urban mobility from a gender perspective, strategies are identified and recommendations are offered for policy decisions in mobility planning towards smarter urban mobility.

Keywords

Mobility; Gender; Technology; Strategy;

Biography

Elvira Maeso Gonzalez has been Senior Lecturer (UK) of the Department of Economy and Business Administration at the School of Industrial Engineering, University of Málaga (Spain) since 1998. She is a Phd. Industrial Engineer (University of Málaga, 2001). Dr. Maeso is the

responsible for the Research Group “Work and Transportation Management”. She launched the Chair of Transport Management in 2004 and directed it up to 2015, when she was appointed Deputy Mayor of Mobility and Transport of the City of Malaga until 2019. She is a responsible researcher and the researcher of numerous contracts and R&D projects related to logistics and transportation. Her main research interest is on transport management of both people and goods that allows greater optimization and efficiency in time, costs, energy, safety, gender equity and environmental impact. Because of her experience, her research spans the development of theoretical models to practical applications on real world policies.

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Modeling and Analyzing a Taxi Market with a Monopsony Taxi Owner and Multiple Rentee-Drivers

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2Department of Civil Engineering, The University of Hong Kong, Pokfulam, Hong Kong, PR China *

Abstract

Taxis offer round-the-clock, comfortable, and direct transportation services. In many cities, a large number (or all) of taxi drivers are rentee-drivers who rent taxis from taxi owners. Therefore, interaction exists between taxi owners and rentee-drivers. To regulate taxi markets effectively, it is necessary to model such interaction and investigate how different regulatory regimes affect stakeholders in taxi markets (e.g., taxi owners, rentee-drivers, and customers) and system performance (social welfare) in the presence of such an interaction. This study extends the classical aggregate taxi model to describe the supply of rentee-drivers and their interaction with a monopsony taxi owner. A general supply function is proposed to describe the supply of rentee-drivers in the market. A profit-maximization model is proposed to describe the decision-making process of the monopsonist and the government, respectively. Analytical and numerical studies are given to illustrate the properties of the proposed model and investigate the effects of fare adjustments and taxi rent/fleet size regulations on the monopsonist, rentee-drivers, customers, and system performance, thereby providing insights into taxi market regulations.

Keywords

Taxi market; Monopsony labor market; Rentee-drivers; Regulation failure.

Biography

Dr. Wai Yuen Szeto is a Professor and an Associate Head at the Department of Civil Engineering at The University of Hong Kong, and the Deputy Director of the Institute of Transport Studies at that university. He is a Top 1 % Scholar 2015-2021 (according to Clarivate Analytics' Essential Science Indicators). His current h-index is 55 (Google Scholar). He is an author of over 155 refereed journal papers, with two papers in Operations Research and 34 papers in Transportation Research Part B. His publications have been cited over 8500 times (Google Scholar). The publications are related to smart and sustainable transport. He received the World Conference on Transport Research Prize (2001), the Eastern Asia Society for Transportation Studies Outstanding Paper Award (2003), the Hong Kong Society for Transportation Studies Outstanding Dissertation Paper Award and the Gordon Newell Memorial Prize (2005), the Hong Kong Institution of Engineers Outstanding Paper Award for Young Engineers/ Researchers (2008), the Best Paper Award of the 10th International Workshop on Computational Transportation Science (2018), and the Outstanding Paper Award of the 2018 China Urban

Transportation Planning Annual Meeting. Currently, he is an Editor of Transportmetrica B, an Associate Editor of Transportation Research Part D and E, Journal of Intelligent Transportation Systems, Transportmetrica A, Travel Behaviour and Society, an Area Editor of Networks and Spatial Economics, and an Editorial Board Member of Transportation Research Part C and International Journal of Sustainable Transportation.

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An Experimental Study on Bond Performance of Hot-dip Galvanized Steel Reinforcement in Poor Quality Concrete

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Abstract

Hot-dip galvanized steel reinforcement (thereafter, HDG) has been known for performing a long-term durability in concrete, because of an anti-corrosion performance of zinc film on the steel substrate. In addition, through the previous studies, it was found that HDG showed similar or a little bit better bond performance than ordinary steel reinforcement in concrete. However, there has been a controversial issue about bond behaviourof HDG due to its surface characteristic of zinc film which makes the rib of steel bar become gradual. Because this property might be interrupting the advantage of deformed bar which contributes to mechanical bond between the rib and concrete, there has been a concernof bond deterioration in applying to RC structure.In this study, to clarify the suitable condition which secures satisfiable and stable bond performance of HDG, concrete quality,which might influence on bond deterioration of HDG,was considered as experiment variables. Specifically, a concrete which is designedas low compression strength or water-rich mix property was experimented.

Keywords

Hot dip galvanized steel reinforcement; Low strength concrete; Water-cement ratio; Bond stress.

Biography

Dr. Choe started his researcher career as an assistant professor in the department of architecture at the Tokyo university of science in Japan since 2020. He obtained his Ph.D degree at the Tokyo university of science. His major studies are evaluating anti-corrosion property and bond stress of galvanized steel reinforcement in concrete. In his doctoral course, He has been focussing on how to improve durability of RC structures by preventing the corrosion of steel reinforcement. After the graduation, his has been expanding his research field from material to structure. For example, his recent studies placed on seismic performance design of RC beams and evaluating bond performance of post-construction anchor. As his recent achievement, He has taken two research project funds which one is KAKENHI from Japan Society for the Promotion of Science (JSPS) and another is from Ohata foundation.

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Fatigue Damage Assessment of Reinforced Concrete Beam using the Magnetic Metal Memory and Acoustic Emission Techniques

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[2]Department of Mechanical and Manufacturing Engineering, Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Malaysia

Abstract

The main objective of this study is to observe the fatigue damage assessment by accessing the behaviour of steel bar in concrete using magnetic flux leakage signal and acoustic emission technique. The acoustic emission technique was used to detect the occurrence of deformation in the reinforced concrete beam. Meanwhile, magnetic metal memory (MMM) was used to determine the flux leakage signal by scanning the beam at the bottom, as bending usually occurs at this point. Two types of high-strength steel bars with a diameter of 10 mm and 12 mm were used in the preparation of the beams. The beams with a bar diameter of 10 mm and 12 mm were designated F10 and F12 respectively. The beam was loaded cyclically at a frequency of 1 Hz and a sine wave mode with a maximum fatigue load of 16 kN and 24 kN respectively. The acoustic emission monitored the behaviour of the beam when the load was applied. Meanwhile, the MMM was scanned along 320 mm in the centre of the beam at three repetitions where the steel bar was located. The magnetic leakage flux signal, crack pattern, acoustic emission features and crack width were measured and evaluated. The relationship between the magnetic flux leakage signal and the crack width as a function of load cycles was investigated and discussed. It was found that there is a strong correlation between these relationships. The behaviour of the steel bar in concrete was determined for both beams. This study is of great importance in determining the behaviour of steel bars under cyclic loading as the integrity of the beam can be evaluated and the life of the beam can be extended.

Keywords

Acoustic emission; Magnetik metal memory; Magnetic flux leakage; Behaviour of steel bar.

Biography

Dr Noorsuhada Md Nor is an Associate Professor of Civil Engineering at Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia. Her expertise is in the field of concrete materials and structures, particularly in the areas of fatigue, retrofitting and rehabilitation, structural health monitoring, advanced materials and signal processing. Dr Noorsuhada obtained her PhD from Universiti Teknologi MARA and her Master from Universiti Teknologi Malaysia, Malaysia. Dr Noorsuhada has been teaching at Universiti Teknologi MARA for more than 15 years. Her main teaching subject is Determinate Structure. She also supervises students pursuing Bachelor's, Master's and PhD degrees. She has published more than 100 scientific articles in journals and international conferences. She has been appointed as a reviewer for journals and conferences like Construction and Building Materials, Engineering Structures,

Structural Health Monitoring, Mechanical Systems and Signal Processing, Materials etc. She has participated in professional activities like conferences, webinars etc. as conference chair, session chair, guest editor for journals, conference committees, editorial board etc. She also serves as an external examiner for PhD and master theses and as a programme and resource person for subject.

Steel Fibre Shear Supplement of Self-Compacting Fibre Reinforced Concrete

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Abstract

The end region of the dapped-end beam experienced multiaxial stress actions, which requires high amounts of reinforcement and this resulted to the closely space reinforcement. Therefore, hooked-end steel fibres were mixed into all beam specimens to partly replace the secondary shear and bursting reinforcement to reduce the congestion issue. A series of experiments were performed on shallow recess (SR) and deep recess (DR) half joint beams to examine the partial reduction of reinforcement with 1% replacement of steel fibre. All SR and DR beams were then tested under shear load to study the effectiveness of steel fibres over traditional reinforcement in resisting loads, with two different shear span-to-depth ratios, which are 1.4 and 2.1. The experimental shear strength fibre supplement results for the SR and DR beam specimens were compared with theoretical predictions using the analytical and RILEM methods. The incorporation of 1% of steel fibre in the concrete matrix has the ability to replace 50% of horizontal and vertical reinforcement in SR and DR beams. In general, it is found that both the analytical and RILEM methods give a close approximation for the experimental DR beam specimen values, but slightly overestimated the fibre shear supplement of SR beam specimens by was 13.4%. The results support the ability of steel fibres to resist tensile stress through its fibre-bridging action.

Biography

Dr. Roslli Noor Mohamed is an Associate Professor from School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia. His expertise is in the area of concrete material and structures, specialized on fibre reinforced concrete,self-compacting concrete, prestressed and precast concrete. Dr Roslli obtained his PhD from University of Nottingham, United Kingdom. Prior to that, he finished his Master and first degree, both from Universiti Teknologi Malaysia. Dr Roslli has involved in teaching in Universiti Teknologi Malaysia for morethan 20 years. Hismain teaching subjects are Mechanic of Materials, Reinforced Concrete Design and Prestressed Concrete Design. Besides, he also supervising undergraduate, master and PhD researchstudents. The output of the research is mainly manifestated in terms of publication. Dr Roslli have authored and co-authored 30 journal articles of which one-third of them were indexed in ISI and others indexed by Scopus and other database agencies. On top of that, he have been appointed as paper reviewer with several journal publication and conferences such as Jurnal Teknologi, APSEC, ISEED-SEPKA and etc.

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High-performance and Low-carbon Structures Fabricated Using Geopolymer-concrete

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Abstract

Steel and concrete composite structural systems are widely applied in the construction of infrastructures such as bridges, buildings and electricity transmission towers, because the structures are designed to best leverage the complementary advantages of steel and concrete material properties. The conventional concrete used to form composite structures is produced using ordinary Portland cement as the binder material. However, the manufacture of cement generates a great deal of CO2 emission which is about 6-9% of the global anthropogenic greenhouse gas emissions and leads to significant environmental impacts.

To reduce the environmental impacts, low-carbon and eco-friendly geopolymer concrete generated using industry by-product has been developed. In order to apply geopolymer concrete to form low-carbon and sustainable composite structural systems, the behaviour of the structures under critical loading conditions was investigated through both experimenting and numerical modelling. The structural resistance, load-displacement responses and failure modes of the structural systems were observed, revealing the adequate structural performance by using geopolymer-concrete. The ultimate strengths of the steel-geopolymer concrete structures were also compared with the strength predictions obtained using the approaches provided for the structural counterparts made of conventional concrete in existing standards. The comparison shows that the approaches are applicable to the composite structural systems made of geopolymer concrete so that they can be applied by practicing engineers for low-carbon infrastructure construction.

Keywords

Steel-geopolymer concrete composite structures; low-carbon; structural behaviour investigation; design.

Biography

Dr. Han Fang is currently a Lecturer in Structural Engineering in School of Civil Engineering at University of Leeds. Prior to this, she was a Lecturer in Structural Engineering and Director of Internationalisation at University of Adelaide in Australia (2019-2022). She received her Bachelor of Civil Engineering with 1st class honour and Dean's honour award from Monash University in 2010 and achieved the PhD in Structural Engineering in 2016 at the same university. From 2016 to 2018, she worked as a Postdoctoral Fellow at the Hong Kong

Polytechnic University and also an Investigator at the China National Engineering Research Centre for Steel Construction (Hong Kong branch).

Her research focuses on the development and design of next generation and sustainable infrastructures with reduced carbon footprint and resilience under disaster conditions. Specifically, she develops durable and low-carbon structural systems with high strength materials and geopolymer concrete and generates mechanism-based design methods for the structures under different service conditions. The research has received the funding support from government and industry grants and research outcomes generated progressively on these topics are presented in 20 journal papers published with JCR Q1 journals. In addition, she also serves as an organising or scientific committee member for different international conferences and provides the review of journal manuscripts for various high impact journals.

Minerals are the New Oil, but Which Ones?

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Abstract
It is now apparent that it is appropriate to phase out fossil fuels (oil, gas, and coal). The planned replacement systems are Electric Vehicles (EV) and Hydrogen Fuel cell vehicles, supported by non-fossil fuel power systems like solar PV, wind, hydro, biomass, geothermal and nuclear energy.To harvest renewable energy sources like sunlight wind, or moving water, technological units like batteries, solar panels and wind turbines are required to be manufactured. This manufacture often requires metals that are not that commonly used or recycled industrially, for example cobalt, neodymium, REE or lithium. The vast majority of the current energy and transport system is dependent on fossil fuels in some form, thus has not be constructed or manufactured yet. This means that recycling cannot be a source for the metal for the manufacture of the non-fossil fuel system, and the mining of minerals will be required instead.
GTK recently published a report that examines what is going to be required to fully phase out fossil fuels as an energy source and replace the entire existing system with renewable energy sources and transportation. This was done by estimating what it would be required to replace the entire fossil fuel system in 2018, for the US, Europe, China, and global economies, and then examined the size and scope of the existing transport fleet, and scope of fossil fuel industrial actions.An estimate of the required quantity of batteries for the EV fleet and stationary power storge, for the task of completely replacing the existing fossil fuel system (in 2018) was estimated to be 2.78 billion tonnes. Assuming all of these batteries were lithium-ion batteries, the estimated quantity of metals (Copper, nickel, lithium, cobalt, and graphite) was compared against reported mineral reserves. It was concluded that global reserves were not sufficient, and alternative battery chemistries, sourced from different minerals should be considered in parallel to the conventional lithium ion battery chemistries.

Keywords
Battery, minerals, reserves, fossil fuels, lithium-ion

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More Environmentally Friendly Construction Materials. CO_2 Incorporation

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2Faculty of Civil and Environmental Science, Bialystok University of Technology, Bialystok, Poland

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Abstract

The sustainable use of natural resources and raw materials, the incorporation of waste in production processes (circular economy) and the mitigation of climate change are currently some of the main global challenges for the preservation of the planet. The concentration of CO2 in the atmosphere has increased from pre-industrial levels of 280 ppm to 420 ppm by 2020 [1].To mitigate climate change, the ONU Climate Change Conference (COP 25) agreed in December 2019 that CO2 levels should be reduced by 45% by 2030 compared to 1990. Construction and demolition waste (CDW) is generated during the construction, lifetime and total or partial demolition of buildings or infrastructure. The production of CDW exceeds 30 billion tonnes per year worldwide [2,3]. In Spain, of the 20 million tonnes of CDW generated in 2014, 9 million tonnes were dumped (without any use) [4]. Carbonation is a well-known natural process in cement-based materials that occurs with CO2 (consuming this greenhouse gas) and the hydration products of cement. In addition, the use of natural aggregates (natural resource) is limited. Replacing these natural aggregates with CDW makes use of a waste and also reduces the use of natural resources. Accelerated carbonation can solve these problems: CO2 consumption and the use of CDW.

Different percentages of replacement of natural aggregate (NA) by recycled masonry aggregate (RMA) were carried out: 0 (MREF), 50 (M50) and 100 % (M100). These specimens were manufactured with a very low w/c ratio (0.4) and were immediately demoulded (in order to mimic a precast plant). The resulting specimens were cured under different conditions (Temperature 21 ± 2 ºC and relative humidity 65 %): normal curing chamber “CC”, with a CO2 percentage of 0.04 %; and chamber with high CO2 concentration “CO2-C”, with a CO2 percentage of 5 %.

The flexural and compressive strength test (UNE EN 1015-11) was carried out at the ages of 1, 3, and 7 days. The bulk density of the hardened mortar (UNE EN 1015-10), as well as the water absorption (UNE 83980) were obtained. All specimens were suitably ground and subjected to X-ray diffraction (XRD) tests as well as thermogravimetric analysis and differential thermal analysis (TGA/DTA) to determine the chemical phases formed and to

evaluate the CO2 capture capacity.
Accelerated carbonation reduced curing time, improved mechanical properties, increased dry bulk density and decreased water accessible porosity in all mixes studied. The maximum capture capacity was 27 kg CO2/t for the RMA-only mixture. Accelerated carbonation of fresh cement-based products containing RMA is a promising CO2 capture and utilisation technology for the manufacture of unreinforced precast concrete products. In this way, more environmentally friendly construction materials can be obtained using waste (circular economy) and CO2 (decarbonisation)

Keywords
Recycled masonry aggregates; Accelerated carbonation; CO2 sequestration; Decarbonisation strategy.

Biography
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Assessing Thermal Comfort using IRT – Preliminary Studies

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Abstract

Infrared thermography (IRT) is a non-intrusive method to measure the surface temperature of an object, with a wide range of applications. In medicine and public health, the measurement of skin temperature using IRT is a promising method that can be useful for the diagnoses of some human diseases. Also, the detection of fever can be performed using this technology, having as main advantage the ability to evade the restrains of the traditional methods, which require contact.

Despite the clear application for medicine and public health, some studies found in the literature suggest the use of IRT to measure body temperature as a parameter for evaluating thermal comfort. Indeed, some thermal comfort models include skin temperature as an input parameter in their approach. The face temperature has been the targeted body area for most of those studies, mainly because this body area is not usually covered by clothing when inside buildings.

Although the promising advantages of the use of IRT to assess thermal comfort, some issues about both the measurement protocol and data treatment remain unclear. This work intends to be a step forward on this topic, attempting to assess the impact of ambient temperature and relative humidity on image resolution, the influence of the subject position regarding the infrared camera and the effect of the equipment characteristics in the results. It also aims to define a procedure that allows relating the results of quantitative IRT to the PMV method, one of the best known and most used methodology to assess thermal comfort in buildings.

To accomplish those objectives, an experimental campaign was carried out inside a climatic chamber, to control the environmental parameters (temperature, T, and relative humidity, RH, of the air). Two infrared cameras, with different characteristics, were used. A total of 99 different scenarios (combinations of T and RH) were established and, for each, thermal images, depicting the face of a young adult (24 years old), were automatically taken.

The experimental results of this study confirm the variation of the facial skin temperature with changes in ambient temperature. However, air relative humidity showed no impact on the results. This work also highlighted that the position of the subject is a key parameter when assessing body temperature and different equipment deliver different results. Regarding the correlation between PMV values and average temperature of the different regions on the face, linear functions were found, with the best results for the cheekbones area and the worst for

the nose. When considering the entire face, the results point to interesting conclusions, as the average facial temperature can be used as indicator for the determination of thermal comfort. Although the interesting results, the prediction model obtained for estimate PMV values using IRT results will require further study with a larger and more diverse group of individuals for validation and/or adjustments.

Keywords
Infrared thermography; Skin temperature; Thermal comfort; PMV method.

Biography
Eva Barreira is an Assistant Professor at the Department of Civil Engineering of the University of Porto – Faculty of Engineering (FEUP). She is responsible for several curricular units of the Bachelor in Civil Engineering (LEC), the Master in Civil Engineering (MEC), the Master in Integrated Building Design and Construction (MPRINCE), the Advanced Studies in Building Rehabilitation (EARPE) and the Doctoral Program in Civil Engineering (PRODEC). She is the head of the Building Division of FEUP, member of the Scientific Committee of MPRINCE and Director of EARPE. She develops research work on hygrothermal behaviour, indoor thermal comfort and energy efficiency of buildings applied to building physics, technology of construction, building pathology and building rehabilitation. She is a member of CONSTRUCT R&D Unit and the Laboratory of Building Physics, both at FEUP. She has participated in various national and international R&D projects and she was member of several scientific and organizing committees of national and international events. She is Guest-Editor of 4 Special Issues. She is the author of 4 international books and more than 150 scientific publications, including about 50 articles in international peer-reviewed journals listed in Science Citation Index (SCI). http://orcid.org/0000-0002-1343-5578 (Scopus h-index: 13).

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Towards the Elliptical Ring Test for Assessing Cracking Potential of Concrete

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Abstract

The circular ring test has been recommended by both ASTM and AASHTO (American Association of State Highway and Transportation Officials) as the standard method for assessing the cracking tendency of concrete and other cement-based materials subject to restrained conditions. The circular ring test could be very time-consuming due to the geometry effect. A modified ring geometry, i.e. elliptical ring, has been approved to be more efficient for assessing the cracking tendency of concrete due to stress concentration brought by its geometry. It has been approved by experiments and numerical modelling that the elliptical ring test can replace the circular ring test for assessing the restrained cracking of concrete. In this talk, the mechanism of the elliptical ring test is to be elaborated based on a fracture model, which also applies to the circular ring test. It has been found that it is the critical crack length corresponding to unstable cracking propagation which determines the advantage of using elliptical geometry in restrained ring tests to shorten test duration. Thin and thick rings demonstrate different cracking behaviour when subject to restrained shrinkage. Elliptical thin rings of certain geometry can shorten the ring test duration as desirable. In analysing the cracking of concrete rings subject to restrained shrinkage, the self-restraint and external restraint effects shall be differentiated. In thin rings, crack initiation is caused by the external restraint effect so that a crack occurs at the inner circumference and propagates towards the outer one. In thick rings, crack initiation is mainly due to the self-restraint effect so that a crack occurs at the outer circumference and propagates towards their inner one. Therefore, thick elliptical concrete rings do not necessarily crack earlier than circular ones as approved by experiment. Therefore, in order to assess cracking resistance of concrete subject to restraint, a thinner concrete ring should be selected in the ring test to enable uniform shrinkage strain across a concrete ring wall, minimising the self-restraint effect associated with the ring geometry.

Keywords

Early-age concrete cracking; Concrete fracture; Elliptical ring; Restrained shrinkage.

Biography

Prof Xiangming Zhou received his BEng degree in Civil & Structural Engineering in 1997 and MEng degree in Structural Engineering in 2000, both from Tongji University, and his PhD degree in Civil Engineering from Hong Kong University of Science & Technology in 2004. He then spent two years at Hong Kong University of Science & Technology and Hong Kong Polytechnic University as a post-doc. He joined the University of Greenwich as a lecturer in structural engineering and was then promoted to senior lecturer in 2007. He

moved to Brunel University as a lecturer in 2008 and was promoted to Senior Lecturer in 2011, Reader in 2016 and Chair in 2018. He was appointed as Head of the Department of Civil & Environmental Engineering in 2018. His research focuses on low carbon cement, alternative binders, construction & demolition waste valorisation, nanotechnology for cement and concrete, rheology of concrete, extrusion and 3D printing of fibre reinforced concrete, restrained shrinkage cracking of concrete, and precast concrete segmental girder bridges. He has published more than 100 papers in mainstream academic journals on construction materials and structures. He has received research grants from UK EPSRC, EU 7th Framework Programme & Horizon 2020, UKIERI, British Council, Royal Academy of Engineering and industry, etc.

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Uncertainty Quantification and Partition for Multivariate Hydrologic Risk Inference

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Abstract

Uncertainties are extensively embodied in hydrologic risk analysis. Particularly for interdependent hydrometeorological extremes, the random features in individual variables and their dependence structures may lead to bias and uncertainty in future risk inferences. In this study, an iterative factorial Bayesian copula (IFBC) approach was proposed to quantify uncertainties and further reveal their contributions to predictive uncertainties in multi-hazard risk inferences. Specifically, an iterative factorial analysis (IFA) approach was developed to diminish the effect of the sample size and provide reliable characterization for parameters' contributions to the resulting risk inferences. The proposed approach was applied to multi-hazard risk analysis for compound extremes to demonstrate the applicability of IFBC for tracking the major contributors to resulting uncertainty in a multivariate framework. In detail, the multivariate risk model associated with correlated variables was established and further introduced into the proposed IFBC framework to reveal the individual and interactive effects of uncertain factors on the predictive uncertainties in the resulting risk inferences. The results suggest that uncertainties in risk inferences would mainly be attributed to some parameters of the marginal distributions while the parameter of dependence structure (i.e. copula function) would not produce noticeable effects. Moreover, compared with traditional factorial analysis (FA), the proposed IFBC approach would produce more reliable visualization for parameters' impacts on risk inferences, while the traditional FA would remarkably overestimate contribution of parameters' interaction to the failure probability in AND, and at the same time, underestimate the contribution of parameters' interaction to the failure probabilities in OR and Kendall.

Keywords

Multi-hazard risk analysis; Copula; Uncertainty; ANOVA

Biography

Yurui Fan: Dr. Fan is a Lecturer in Flood and Coastal Engineering at the Department of Civil and Environmental Engineering at Brunel University London. He is an outstanding young researcher in the field of water and environmental systems analysis, especially in stochastic processes and statistical hydrology, flooding risk analysis, water resources management and climate change and adaptation. Fan has produced more than 80 refereed journal papers with an H-index of 33 from Google Scholar and participated more than 20 research projects since 2009. He was an Editor assistant for the Journal of Environmental Informatics (2011-2018), and one editorial board member for Water and Environmental Systems Research (Springer). Fan has developed a series of stochastic modelling systems for supporting flood prediction, inferring risks for flooding events and compound hydroclimatic extremes. Some of his research works have been published on some prestigious journals such as Water Resources Research,

Hydrology and Earth System Sciences, IEEE Transactions on Fuzzy Systems, Journal of Water Resources Planning and Management (ASCE), Journal of Hydrology, Earth's Future and so on. Before joining Brunel, Fan obtained his Ph.D degree from the University of Regina, Canada in 2015 and also had been a research fellow at the Institute for Energy, Environment and Sustainable Communities at the University of Regina from 2015 to 2018.

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The Key Role of Soil Dynamic Characterization in Earthquake engineering issues

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Abstract

The resonant column (RC) and cyclic triaxial (CT) devices are commonly used for the measurement of soils' dynamic properties. The variation of dynamic properties of soils (shear modulus and damping ratio) as a function of shear strain and loading frequency are crucial input for solving geotechnical problems involving dynamic loadings. Several methods are used to measure these dynamic properties using different devices. Cyclic triaxial (CT) and resonant column (RC) devices are widely used to evaluate dynamic properties of soils following relevant ASTM standard tests. They operate at a wide range of strain levels (10^{-5} % < γ < 100 %) and excitation frequencies (0.01 Hz < f < 100 Hz). Resonant column tests are commonly performed at frequencies ranging from 10 to 100 Hz and low- strain levels, whereas in CT testing frequencies between 0.01 and 2 Hz and higher strain levels are typically used.

The talk describes how the dynamic characterization of soil play a key role in several problems of earthquake geotechnical engineering by contributing to define the subsoil model for the purposes of seismic response analysis, seismic microzonation, liquefaction phenomena.

Thematic maps, such as seismic risk maps, are a useful tool that researchers use for representing the adverse outcomes that a natural catastrophic event can have over the territory. Generally, in those studies, major attention is focused in urban areas, where the human activities are concentrated. Main concerns are about the existing building stock, mostly composed by structures not compliant with modern seismic design criteria. The realization of a risk map is a complex task that involves the combination of data coming from different field of expertise, such as geology, geotechnical and structural engineering.The prospecting and surveying techniques (geological surveys, drilling, down- hole, MASW) allow a decisive improvement in the geological knowledge of the studied area. Moreover, the seismic geotechnical characterization can be obtained by laboratory tests including the resonant column and cyclic torsional shear test on undisturbed samples. The available data can be combined together in a Geographical Information System tool. The results provide a reliable representation of the seismic risk at urban scale to be used when planning the mitigation measures to be undertaken in order to improve the prevention and reduction of the disastrous effects of the earthquakes.

Keywords

Dynamic Properties; Seismic response analysis; Mcrozonation.

Biography

Valentina Lentini is Associate Professor of Geotechnical Engineering at the University Kore of Enna (Italy). The research activities is mainly devoted to geotechnical earthquake engineering with particular reference to the soil dynamic characterization by means of laboratory test but also to landslide risk and shallow foundation. She is Visiting Professor at UPC Universitat Politècnica de Catalunya. She is external reviewer for international geotechnical journals. She is Author and co- author of about 80 scientific papers, also published on prestigious journals. She has attended numerous national and international conferences, often presenting her scientific works as an invited lecturer. She is currently a member of the Italian Geotechnical Engineering Group Executive Committee (2021- 2024) and a member of the International Society of Soil Mechanics and Geotechnical Engineering

Technical Committee TC101 on Laboratory Testing. She is a member of the Editorial Board of the Bulletin of Engineering Geology and the Environment. She is actively involved in the management of activities of the Soil Dynamics and Geotechnical Engineering Laboratory of the University of Enna as Director of the Laboratory. She is part of a research group involved in numerous research projects with the Italian Ministry of Scientific Research. She was a member of the Scientific Committee for several International Conference on Geotechnical Engineering. Since 2014 she has been deeply involved with the teaching activity in Soil Mechanics and Geotechnical Engineering at the University of Catania and Enna (Italy). Professor Lentini has interests in the field of geotechnical earthquake engineering, rainfall-induced landslides and shallow foundation.

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When Floods Hit the Road: Quantifying the Resilience of Urban Transportation Systems to Coastal Flooding and Sea Level Rise

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Abstract

Climate change and sea level rise are increasing the frequency and intensity of coastal floods. Many coastal communities around the world are facing increasing risks of flood impacts. For major coastal cities, the transportation system is a critical urban network that facilitates the socioeconomic functioning of the city. Coastal flooding can inundate low-lying roads and highways, causing spatially extensive disruption throughout the transportation system. Many transportation systems around the world are already highly congested. Flooding can drastically increase such congestion, causing region-wide impacts such as substantial travel time delays, as well as increased accident rates in residential communities.

Recent work has made advances in quantifying transportation resilience, namely the ability of transportation systems to withstand disruption from natural and climatic hazards such as coastal flooding. In particular, prior studies quantify transportation resilience in terms of how well the system mitigates increases in travel time. However, the focus on travel time alone may bias adaptation planning efforts toward travel efficiency, at the cost of other priorities such as road safety.

The goal of our study is to quantify the resilience of urban transportation systems more broadly, by estimating both travel time delays as well as car and pedestrian accident rates under flood conditions. For our analysis, we develop a transportation model to simulate regional traffic patterns for a given metropolitan region. We use regional coastal flood projections over the 2020-2040 period to identify potentially flooded roads and highways. We then simulate regional traffic patterns under flood conditions by closing down such potentially flooded roads within the simulations. We use the traffic simulations and historical data to estimate changes in travel time delays, and car and pedestrian accident rates. Our analysis is based on the San Francisco Bay Area region, which is a prime example of densely populated, economically active coastal region facing increasing coastal flood risk.

Our results show that flood-related traffic disruption is not a coastal problem but a regional one. The impacts of flooding propagate congestion through the network, increasing travel times and accident rates far beyond the areas of flooding. Our estimates of flood-related travel time delays and accident rates also show contrasting pictures of resilience. For example, the availability of alternate roads offsets travel time delays caused by the flooding of nearby roads and highways, because the disrupted traffic may be rerouted along the alternate roads. However, such alternate roads often consist of local streets that pass through residential communities. The potential increase in traffic volumes on such streets increases the rates of car and pedestrian accident rates within the local communities. As a result, our work highlights the need for holistic transportation adaptation planning, balancing both priorities of travel efficiency and road safety.

Keywords
coastal floods; transportation; sea level rise; resilience.

Biography
Dr. Indraneel Kasmalkar is a researcher in the field of urban resilience to climate change. He is currently a postdoctoral research fellow at the Earth Observatory of Singapore, Nanyang Technological University, Singapore. He completed his undergraduate studies in Mathematics at the University of California, Berkeley, and his PhD in Computational and Mathematical Engineering at Stanford University. Dr. Kasmalkar develops mathematical models for quantifying the impacts of coastal flooding and sea level rise on urban transportation systems. His research combines climate science, mathematics, and engagement with local stakeholders to provide quantitative, actionable insights into urban resilience.

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Sustainable Design for Exterior Wall Painting

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Abstract

Various materials such as paint, metal, and tile are used for the exterior of the building. In particular, paints are inexpensive, have many types of colors, and have a large degree of freedom in design. Furthermore, it is a convenient material that can change the impression of the building by repainting. On the other hand, there is a problem that the durability differs depending on the type of material.

In recent years, the durability of paints has been improved, and photocatalysts and hydrophilic low-contamination paints have been developed, but they have not been improved such as rain streak stains. Maintaining the aesthetics of a building is one of the important items that determine the value of a building. Therefore, in condominiums and the like, dirt removal work on the exterior wall is one of the large-scale repair work items.

The purpose of this study is to maintain the aesthetic appearance of the outer wall by forming fine irregularities on the painted surface. In this report, we prepared a test piece in which fine irregularities of 5 to 300 μm were formed in the coating. An exposure test was performed to measure the water contact angle and color difference on the surface. As a result, it was confirmed that even if the same paint was used, the color difference greatly differed depending on the conditions of the surface unevenness, and the condition range in which stains were less likely to occur was found.

Keywords

Sustainable design; Exterior wall; Exposure test; Water angle

Biography

Dr. Kaori Nagai is a Professor in the Department of Architecture and Architectural Engineering, College of Industrial Technology at Nihon University in Chiba, Japan. Prof. Kaori Nagai also serves as Vice-President for the Japan Society for Finishings Technology. She was a research engineer at the research center in Taisei corporation after graduation from the university. After this, she has been teaching and research experience at Nihon University. She organizes the Material Design and Construction Strategy Laboratory in the university. She was a guest researcher for the Fraunhofer ILT, RWTH Aachen University in Germany from 2017 to 2018. Her main research projects are Application of Laser for Construction, Durability evaluation of building materials, Research on large-scale repairs of skyscrapers, Research on maintenance of historic buildings, Research on the removal of asbestos-containing building materials, Research on maintenance of noncombustible wood.

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The Recycling of a Concrete with Known Properties to Reproduce a Durable Material for the Civil Engineering Infrastructure

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Abstract

Cements added with supplementary cementitious materials and concrete recycling are among the most currently investigated issues in the construction field. The use of cement-based waste increased steadily. The recycled materials generally exhibit satisfactory mechanical properties. Nonetheless, the durability requirements are sometimes difficult to achieve. This is also due to the unkonwninhomogeneityof the recycled material aggregates that are blended to produce concrete. In this work, a class C 30/37 compressive strength concrete with environmental exposition classes XC4, XD3, XF4, XD2 added with fly ash was investigated with respect to the main mechanical parameters. Furthermore, the main durability aspects were characterized: porosity and water permeability, freeze-thaw resistance in the presence of NaCl salt, the chloride penetration and the accelerated carbonation. After 28 days the original material was demolished and cementitious aggregates were produced. The aggregates were added to natural stone aggregates to form new concrete blends in the percentage of 25, 50 and 100 % by mass. The recycled blends exhibited similar compressive strength at 28 days. On the other hand, the same values of freeze/thaw resistance and an improved resistance to the other durability parameters were measured, in particular for the mixtures containing 50 and 100 % weight of recycled concrete aggregates. This allow them to be used for infrastructures, such as tunnels and bridges, where the durability requirements are particularly high.

Keywords

Recycling,concrete, durability, sustainability.

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Driving Sustainable Development through Energy Sustainability

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Abstract

Sustainable development is an important objective for human and societal activity. Energy sustainability is of great importance to any plans for overall sustainable development. This is particularly important given the pervasiveness of energy use, its importance in economic development and living standards, and the significant impacts that energy processes and systems have on the environment.

Many factors that need to be considered and appropriately addressed in moving towards energy sustainability are examined in this talk. These include appropriate selection of energy resources bearing in mind sustainability criteria, facilitation of the use of sustainable energy resources, enhancement of the efficiency of energy-related processes, and a holistic adoption of environmental stewardship in energy activities. In addition, other key sustainability measures are addressed, such as economics, equity, land use, lifestyle, sociopolitical factors and population. Conclusions are provided related both on options for energy sustainability and on means to achieve sustainable development.

Keywords

Sustainability; sustainable development; energy; environment.

Biography

Marc A. Rosen, Ph.D., is a Professor at Ontario Tech University (University of Ontario Institute of Technology) in Oshawa, Canada, where he served as founding Dean of the Faculty of Engineering and Applied Science. Dr. Rosen has served as President of the Engineering Institute of Canada and of the Canadian Society for Mechanical Engineering. He has acted in many professional capacities, including Editor-in-Chief of various journals and a Director of Oshawa Power and Utilities Corporation. With over 70 research grants and contracts and 900 technical publications, Dr. Rosen is an active teacher and researcher in sustainable energy, sustainability, and environmental impact. Much of his research has been carried out for industry. Dr. Rosen has worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, the Institute for Hydrogen Systems near Toronto, and Ryerson University in Toronto, where he served as Chair the Department of Mechanical, Aerospace and Industrial Engineering. Dr. Rosen has received numerous awards and honours, and is a Fellow of numerous societies.

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Community and Infrastructure Resilience in Construction and Civil Engineering Education

Saeed Rokooei

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Abstract

Community and infrastructure resilience are among topics that are receiving particular attention from both academia and industry. The abundance of natural hazards in the past decade and the ascending trend of frequency and magnitude of catastrophic hazards necessitate structured educational modules in construction and civil engineering programs. Despite this urgent need, the portion of courses or educational modules that offer community and infrastructure resilience content triggers concerns about their adequacy and effectiveness. While these concerns are addressed by different methods and based on various perspectives, students' perceptions and knowledge about the community and infrastructure resilience areas indicate the extent to which ample and effective information is conveyed to construction and civil engineering students. This study aims to explore students' perceptions toward different aspects of the community and infrastructure resilience areas. A quantitative research approach was used to investigate to what levels participants are familiar with definitions, key terms, aspects, and entities involved. A survey was designed, developed, and distributed to fifteen construction/civil engineering schools in the U.S. The results showed that students were not adequately familiar with major components of community and infrastructure resilience areas. In addition, statistical results indicated a lack of coherent view toward the subject as a whole. While some indications showed the lack of sufficient educational content, students emphasized their interests in knowing more about the subject. Also, students reported the community and infrastructure resilience path as their professional careers. Overall, the study showed potential features to be developed or revised and added to the constriction or civil engineering curricula.

Keywords

Resilience, Infrastructure, Community, Education.

Biography

Saeed Rokooei is an assistant professor in the Building Construction Science program at Mississippi State University. His professional responsibilities include project planning and management as well as architectural design practice in private and public construction and engineering firms. He has taught in architecture and construction programs since 2006.

Dr. Rokooei's primary research interests include simulation and serious games, project management methodologies, construction education, data analytics, creativity and innovation, and emerging technologies. He is actively pursuing the development of educational techniques and methods in construction. He has developed construction-based simulation applications and strives to bring aspects of project management into simulation applications.

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Using WRF to predict the Maximum Temperatures in summertime (2050- 2060) over the desert of the Arabian Peninsula

Hussain Alsarraf

Department of Mathematics and Natural Sciences American University of Kuwait

Abstract

This study to evaluates three different land surface models in Weather Forecast Research (WRF) model to predict the maximum temperatures during summer season. The five layers' (5L) thermal diffusion, rapid update cycle (RUC), and Noah chosen based on nature of the environment topography. The WRF simulations of 10 years over the Arabian Peninsula and Kuwait were conducted during the summer from May to September (2000–2010) to evaluate the sensitivity of the WRF model dynamical downscaling from the Community Climate System Model (CCSM 4) in three nested-grid resolutions. The land-surface model in WRF affect strongly the temperature simulations over the desert region. The best agreement between observation and simulation was found in the case of WRF with Noah land surface to be used for predictions. The future predictions May to September (2050-2060) predicted an increase 1-3 ◦C during the summer season over the Arabian Peninsula and Kuwait. The results reveal that the more effective 4-km high-resolution WRF domain using Noah land surface model should be considered for weather, and climate predictions over the Arabian Peninsula and Kuwait.

Keywords

High-Resolution WRF; surface maximum temperatures, Climate change, Global Warming

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