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Annual International Conference on Data Science

22-25 June 2020, Athens, Greece

Edited by
Gregory T. Papanikos

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Abstracts
Annual International Conference on Data Science

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(In Alphabetical Order by Author's Family name)

Preface

This book includes the abstracts of all the papers presented at the ***Annual International Conference on Data Science*** *(22-25 June 2020)*, organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications.

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

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world regularly meet to discuss the developments of their discipline and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published nearly 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together. Specific individuals are listed on the following page.

Gregory T. Papanikos
President

Annual International Conference on Data Science, 22-25 June 2020, Athens, Greece

Scientific Committee

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by chairing the conference sessions and/or by reviewing the submitted abstracts and papers:

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Timothy M. Young, Professor and Graduate Director, The University of Tennessee, USA.
3. Theodore Trafalis, Professor of Industrial & Systems Engineering and Director, Optimization & Intelligent Systems Laboratory, The University of Oklahoma, USA.
4. Dimitrios Goulias, Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.

FINAL CONFERENCE PROGRAM
Annual International Conference on Data Science, 22-25 June 2020, Athens, Greece

PROGRAM

Monday 22 June 2020

10.00-10.30
Registration

10.30-11.15
Opening and Welcoming Remarks:

- **Gregory T. Papanikos**, President, ATINER.
- **Theodore Trafalis**, Professor of Industrial & Systems Engineering and Director, Optimization & Intelligent Systems Laboratory, The University of Oklahoma, USA.
- **Timothy M. Young**, Professor and Graduate Director, The University of Tennessee, USA.
- **Dimitrios Goulias**, Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.

11.15-11.45
Marcus Kurth, Professor, University of Technology, Business and Design Konstanz, Germany.
Title: *Filling the Industrial Data Lake in Manufacturing Companies based on KPIs.*

11.45-12.00 Break

12.00-12.30
Aniruddha Sengupta, Professor, Indian Institute of Technology Kharagpur, India.
Title: *Numerical Validation of Cyclic Triaxial Tests Conducted on Saturated Kasai River Sand.*

12.30-12.45 Break

12:45-13:15
Alessio Domenico Leto, PhD Student, Politecnico di Milano, Italy.
Title: *Building Information Modelling in Small and Medium Enterprises: A Systematic Literature Review.*

13.15-13.30 Break

13:30-14:00
Stefan Oertker, Research Assistant, FH Münster, Germany.
Title: *Compressive Strength of Sand-Filled Plastic Bottles.*

14.00-14.15 Break

14:15-14:45
Marie Reichert, Scientific Assistant / Civil Engineer, Technische Universität Kaiserslautern / Bollinger + Grohmann Ingenieure, Germany.
Title: *Evaluation of Fire Resistance for Injection Anchors with Variable Embedment Depths.*

14.45-15.00 Break

15:00-15:30
Xavier Fernando Hurtado Amezquita, PhD Researcher, Universidad Nacional de Colombia, Colombia.
Title: *Alternative Fastening Mechanism for Shear Connectors with Cold-Formed Steel Profiles Involved in Composite Sections.*

15.30-15.45 Break

15:45-16:15
Nur Yazdani, Professor, The University of Texas at Arlington, USA.
Title: *Non-Destructive Evaluation of FRP Laminate-Concrete Interface Bond with Surface Defects.*

16.15-16.30 Break

16:30-17:00
Timothy M. Young, Professor and Graduate Director, The University of Tennessee, USA.
Title: *Evolutionary Operation (EVOP) as Deduction Phase for Improving Machine Learning.*

17.00-17.15 Break

17:15-17:45
Dimitrios Goulias, Associate Professor & Director of Undergraduate Studies Civil & Environmental Engineering Department, University of Maryland, USA.
Title: *Optimizing Alternative Sustainable Solutions for Roadway Projects.*

Tuesday 23 June 2020

11:00-11:30
A. Rasem Hasan, Director of Water and Environmental Studies Institute, An-Najah National University, Palestine.
Title: *Brackish Water Desalination by Capacitive Electro-Dialysis.*

11.30-11.45 Break

11:45-12:15
Fady M. A Hassouna, Assistant Professor, An-Najah National University, Palestine.
Title: *Electric Vehicles as an Alternative to Conventional Vehicles: A Comprehensive Review.*

12.15-12.30 Break

12.30-13.00
Jagannadha Rao Subramanya Konathala, Senior Manager-Quality, Yongnam

Engineering & Construction (Pte) Ltd, Singapore.
Title: *Application of Flux Cored Arc Welding (FCAW) without Pre-heating for Heavy Structures in Ship Building Fabrication & Construction of Heavy Offshore Structural Steels.*

13.00-13.15 Break

13:15-13:45
Manfred Juretzko, Research Associate, Karlsruhe Institute of Technology, Germany.
Title: *Monitoring the Stress Tests of the Karlsruhe Rhine Bridge with Synchronized Total Stations.*

13.45-14.00 Break

14:00-14:30
Saddam Hussein Ali Abo Sabah, Postdoctoral Fellow, Universiti Sains Malaysia, Malaysia.
Title: *The Effect of Honeycomb Core Thickness on the Repeated Low-Velocity Impact Behavior of Sandwich Beams.*

14.30-14.45 Break

14:45-15:15
Marta Cristina Zaharia, Senior Scientific Researcher III, NIRD URBAN-INCERC, Romania.
Title: *The Influence of the Coefficient of Acoustic Absorption of the Facades of the Buildings from the Street Profiles, on the Noise Level from the Urban Road Traffic.*

Alessio Domenico Leto
PhD Student, Polytechnic University of Milan, Italy

Building Information Modelling in Small and Medium Enterprises: A Systematic Literature Review

According to the European Directive 2014/24/EU, the European Member States may require in the coming years the use of Building information Modelling (BIM) for public tenders. More than 99% of the European construction market is composed by SMEs [1], and SMEs are late in the adoption of BIM. As a consequence, the Small and Medium enterprises represent the keystone for the spreading of this digital methodology. The present work aims to provide the state of the art of the research on BIM adoption by SMEs through a systematic literature review. The analysis of more than 120 papers, coming from international referred journals and proceedings, identified 45 of them as relevant for the study through specific keywords and an in-depth investigation. The output is a framework of the academic literature on the BIM adoption by SMEs. The research would be of interest for both industrial decision makers and policy makers. The former would take benefit from a study resuming the current issues on BIM implementation by SMEs, the latter would get a theoretical basis to develop and assess more effective policies to support SMEs to use BIM.

Xavier Fernando Hurtado Amezquita
PhD Researcher, National University of Colombia, Colombia

Alternative Fastening Mechanism for Shear Connectors with Cold-Formed Steel Profiles Involved in Composite Sections

Over the past few decades, the use of steel-concrete composite sections has increased globally; its basic principle of use is taking advantages of mechanical properties of materials. In this way, steel sections can resist high compression stresses, but slender members reduce their efficiency due to their potential instability induced by lateral buckling, torsional buckling and/or local buckling, mainly in open sections. Therefore, the optimization of composite section is aimed at concrete resists compression stresses and steel shear and tensile stresses.

Assembly of these systems implies inclusion of stress transference elements between materials, called shear connectors, which also control possible differential displacements that may be presented in the connection interface.

This mixed-elements configuration was initially proposed for bridges, and, according to good structural performance, its uses were expanded to flooring systems in buildings.

Recently, within technologies with better structural efficiency, Cold-Formed Steel sections (CFS), have increased their structural uses in medium and small buildings, becoming a competitive alternative against Hot-Rolled Steel sections (HRS), heavier but commonly used in conventional infrastructure.

Among its main advantages are versatility in generation of geometric configurations, possibility of using in long spans, ease of industrial production, high strength-to-weight ratio, speed in packaging, transport and assembly, allowing these sections to be considered as an alternative of sustainability in construction.

According to conventional methodology of fastening welded connectors, endorsed by current normative, uncertainty has been generated, because it is a thermal process in which local residual stresses are induced, in steel profiles and connectors, being of particular care CFS sections, due to heat of electrode can perforate profile plates.

Therefore, different alternative mechanical fastening systems have been studied in CFS profiles, in order to ensure an adequate system connection, without having to depend on welding process.

Among main proposals are Hanaor (2000) using screws and washers, and expansive screws in hardened concrete, Fontana & Bartschi (2002) applying powder-actuated fastening systems, Queiroz (2010) using bolted screws and Lakkavalli (2006) using self-drilling screws as shear connectors, with an adequate connection and stress transfer between materials. It should be noted that bolted joints have not been technically endorsed, due to lack of standardization of tests, that would allow to develop a design methodology.

Thus, knowing the disadvantages of welding and possibility of incorporating efficient alternative mechanisms for mechanical fastening of shear connectors, a proposal for clamping connectors is presented. The procedure makes use of self-drilling screws. The system was initially compared with powder-actuated nails mechanism. Test results confirmed advantages of proposed system in terms of mechanical adhesion and structural behavior.

In addition, efficiency of the proposed system was validated through experimental shear test between steel plates and composite section beam tests, ensuring fixing of connectors to steel profile after system failure.

Dimitrios Goulias
Associate Professor & Director of Undergraduate Studies, Civil & Environmental Engineering Department, University of Maryland, USA

Optimizing Alternative Sustainable Solutions for Roadway Projects

In order to reduce environmental impact of transportation facilities it is critical to implement sustainable solutions in construction and rehabilitation of roadways. Recycling of pavement materials is a key element in generating sustainable pavement structures with significant savings in new materials, reduction in cost and energy. It was the objective of this study to assess environmental and economic benefits of pavement recycling materials and thus suggest a life cycle analysis method that could be implemented in optimizing alternative sustainable solutions. In this effort an off the self-analysis tool was used. To demonstrate the methodology and quantify the environmental and economic benefits of in-situ and ex-situ recycling, different levels of recycling were used. Greenhouse gas emissions, energy consumption water consumption and cost associated with construction, maintenance and transportation of the materials were included in the analysis. The methodology presented in this study can be used elsewhere to identify the best (i.e., optimum) sustainable design solution for a specific project.

A. Rasem Hasan
Director of Water and Environmental Studies Institute, An-Najah National University, Palestine

Brackish Water Desalination by Capacitive Electro-Dialysis

Water shortages in Palestine and other places in the world urge the replacement of freshwater demand of agriculture and potable water with alternative sources. In addition, the water and energy crises in Gaza can be mitigated by water treatment technology, that is robust, inexpensive, easily operated, and with low energy demand. A water treatment method based on innovative capacitive electro-dialysis (CED) was developed. A pilot scale model with a stack of 48 acrylamide membranes and (10×40 cm) of 150 μm wire diameter, spaced with spacers with the same material and size, of 600 μm mesh size, housed between two carbon-sheets electrodes, and operated with counteracting polarity, was used. Water is pumped through the system from a raw water tank. The pilot setup was designed to treat water for irrigation and drinking water purposes. For the purpose of testing the device, a sampling campaign for brackish water in Jericho was conducted in March 2018. Several samples were collected from groundwater wells and analyzed for salinity levels and heavy metals. Salinity levels in the range of 3-6 g/l as NaCl were simulated at Water Future BV and used for testing the pilot system. Several experimental runs were conducted, and electrical conductivity was reduced from 5260 to around 500 μs/cm in 30 minutes' cycle for treatment of 2 m^3 with an average energy consumption of less than 3 KWh/m^3 water. The pilot CED device can be set to produce water with the required quality based on the purpose of use, and in this way a decrease in energy consumption can be achieved to make it competitive to traditional reverse osmosis systems that demand energy in the range of 3-10 KWh/m^3 and without affecting the quality of water, need for further treatment, and production of brines.

Fady M. A Hassouna
Assistant Professor, An-Najah National University, Palestine

Electric Vehicles as an Alternative to Conventional Vehicles: A Comprehensive Review

Electric vehicles have been developed during last two decades as one of the solutions for reducing the toxic emissions and energy consumption of the transportation sector. However, the higher manufacturing cost of electric vehicles is a main barrier for the electric vehicle industry comparing to manufacturing cost of conventional internal combustion engine vehicles; moreover, the cost-benefit analyses and other related studies cannot figure out all benefits and negative attributes of electric vehicles as compared to conventional, internal-combustion vehicles. Recently, an important question about this issue has arisen: Is the electric vehicle the best solution for saving energy and the environment, when considering its cost, mobility, and sustainability? In order to answer this question, the existing literature related to electric vehicles and both their benefits and negative attributes, in all aspects, have been reviewed and analyzed. In this study, the literature concerning all aspects of electric vehicle performance (environmental, energy, cost, mobility, sustainability) were analyzed. In addition, the extent of conflicts among the different factors that affect the performance of electric vehicles were determined in order to clarify the overall picture of electric vehicle performance, as compared to that of conventional internal-combustion vehicle and, finally, to present the overall findings of the study's analysis.

Manfred Juretzko
Research Associate, Karlsruhe Institute of Technology, Germany

Monitoring the Stress Tests of the Karlsruhe Rhine Bridge with Synchronized Total Stations

With a length of 292 m and a daily traffic volume of approx. 80,000 vehicles, the Karlsruhe Rhine Bridge is one of the most important transport links in southwestern Germany. After over 50 years of use, it has been redeveloped using a novel process using a special road concrete. The following article describes the construction of the bridge and the damage to the bridge resulting from many years of use. It will be shown how to relieve the steel structure of the bridge with the use of high-strength concrete in the road surface. The impact of this construction project was examined by an interdisciplinary team of scientists from the Karlsruhe Institute of Technology (KIT). To monitor the condition of the bridge during the various stages of construction, in addition to a large number of non-geodetic sensors, two synchronously operating total stations were used. With these, the absolute movement of selected points of the bridge in various load tests with submillimeter accuracy could be recorded. The use and the results of the total stations are the focus of this article.

Marcus Kurth
Professor, University of Technology, Business and Design Konstanz, Germany

Filling the Industrial Data Lake in Manufacturing Companies based on KPIs

In order to exploit the potential of digitalisation entirely defined digitalisation targets are required. These must be derived from an overall corporate strategy with clear motives. For small and medium-sized enterprises (SMEs) in particular, the efficient implementation of digitalisation projects aiming at fulfilling superior business objectives is highly challenging. Usually a transformation to digitalisation based on a technology-oriented perspective leads to vast investments and implementation costs e.g. for the required hardware and software components. Therefore, a rethinking away from technology orientation to an application-oriented implementation is necessary. This new focus requires a systemic approach to the generation of key performance indicators (KPIs), which are derived from the corporate strategy broken down to production level. The newly developed stepwise methodology for generating KPIs was developed in cooperation with Sola Messwerkzeuge GmbH, an internationally operating SME specialized in the production of high precision measuring tools. This paper describes an iteration loop-based approach for generating KPIs by fulfilling defined iteration criterial like resolution, update rate, margin of error, cost of implementation, etc. to reach an optimal sensor placement at production level and preserve a single source of truth principle regarding data redundancy. Starting with a description of fundamental motives and drivers for the implementation of digitalisation projects in production, general steps for automation as well as the current "as-is" situation in the considered company are presented in order to create a common understanding. Afterwards, the methodology for systemic generation and implementation of a corporate KPI system is explained and linked with an exemplary application for the production processes of spirit levels. This procedure is characterized by a syntactic and stepwise approach with the aim to structure KPI's in order a to identify the KPI with the greatest effect on achieving corporate strategy's objectives. In addition, the implementation of the methodology in the considered company aims at achieving cost efficiency and exploiting synergy effects such as for the derivation of further KPIs.

Stefan Oertker
Research Assistant, FH Münster, Germany

Compressive Strength of Sand-Filled Plastic Bottles

The processing and recycling of waste is an essential part of today's consumer-oriented society. In particular, developing countries are affected by excessive amounts of plastic waste. This is incinerated or ends up in nature, rivers and the oceans. Plastic can only be degraded very slowly in nature and offers unacceptable living conditions for nature, animals and mankind. In order to reduce plastic waste, organizations in parts of South America, Asia and Africa have been using plastic bottles meant for garbage to build houses quickly and cheaply. The cleaned bottles are filled with sand or earth, compacted, screwed down and used lying down as a brick replacement with mortar layers. A mathematical proof is not executed and replaced in the doubt by load tests after finishing the elements. This research experimentally tests the individual compressive strength of sand-filled commercial plastic bottles and the load-bearing capacity of a wall section in a clear composite test. The fundamentals of plastic bottle wall systems are created in order to formulate conditions for safe load transfer and to provide a minimum level of safety for the occupants. During the laboratory tests two different types of plastic bottles were investigated, Type I (PEHD) and Type II (PET). First, the compressive strength of a bottle made from PEHD (Type I) was determined using 60 test specimens in a compression testing machine. To check the relevance of the filled material, 30 bottles were filled with desert sand and 30 bottles with river sand. The failure modes of the bottles were longitudinal tearing of the outer surface and less frequent bottom failure. The average compressive strengths for bottom failure were 18.3 kN (river sand) and 18.9 kN (desert sand), while they were 116 kN (river sand) and 111 kN (desert sand) longitudinal tearing of the outer surface. Subsequently, 30 further test specimens of a bottle made from PET (type II) were examined. These specimens were filled exclusively with desert sand due to the minor differences between the filled materials. The test specimens achieved an average compressive strength of 17.9 kN. Only longitudinal tearing of the outer surface was seen. Throughout this research, the tensile strength of the materials and the material thickness of the plastic bottle were also determined. In addition, pressure foils were used to determine the base tension of individual surfaces. In a first composite test, additional results on the overall load-bearing behaviour of a plastic bottle wall system could be

collected. So far, the tests have shown that a safe removal of existing loads can be guaranteed. Ecological, cost-effective and fast construction seems to be possible.

Marie Reichert
Scientific Assistant / Civil Engineer, University of Kaiserslautern /
Bollinger + Grohmann Ingenieure, Germany

Evaluation of Fire Resistance for Injection Anchors with Variable Embedment Depths

In the last decades bonded anchors became a common fastening system. With the frequent use, the requirements in load capacity and the fields of application expands. Therefore, there is also the demand for assessments in case of fire. At the same time the knowledge about the load-bearing behaviour under fire is small. In this scientific work the impact of high temperature loads on anchors is determined by static calculations and thermal-transient simulations. Furthermore, the load capacity and load-bearing behaviour of bonded anchors concerning bond failure is investigated experimentally for mortar temperatures between 20°C and 400°C. Influencing factors on the bond stress-temperature behaviour of injection mortars like anchor diameter, moisture of concrete, internal and external forces and the type of test execution are examined. As a result of the presented research a calculation method for the bond failure on the basis of temperature profiles and the behaviour of the load capacity of bond materials under high temperatures is presented. Also, numerous experimental results concerning steel failure are assessed and load capacities for commercial threaded rods for the fire resistances R30, R60, R90 and R120 are given. In total the research work shows and evaluates the complexity of fire events and the numerous influencing factors on injection anchors. Fire resistances or rather methods for the calculation of fire resistances on the safe side can be given. Nevertheless, the confirmation with experimental tests in real fire tests cannot be completely replaced.

Saddam Hussein Ali Abo Sabah
Postdoctoral Fellow, Universiti Sains Malaysia, Malaysia

The Effect of Honeycomb Core Thickness on the Repeated Low-Velocity Impact Behavior of Sandwich Beams

In a recent study, a new bio-inspired honeycomb sandwich beam (BHSB) mimicking the head configuration of the woodpecker was developed. The beam consists of two carbon/epoxy composite face sheets, aluminum honeycomb core, and rubber core to enhance the repeated low-velocity impact resistance of sandwich structures. This paper aims to numerically enhance the repeated low-velocity impact resistance of the BHSB via optimizing the aluminum honeycomb core thickness. The beam was investigated employing three core thicknesses: 20 mm, 25 mm, and 30 mm at three impact energy levels (13.5 J, 15.55 J, 21.43 J). The results revealed that increasing the thickness of the aluminum honeycomb core to a certain level enhances the sandwich beam stiffness. The beam with the 25 mm honeycomb core thickness was the only beam that can sustain five repeated impacts achieving the highest impact resistance efficiency index, especially at high energy levels. Furthermore, the bottom face sheet of this beam developed the lowest stresses indicating that this thickness has a relatively better performance during impact events since it allowed minimal stress to reach the bottom face sheet. Overall, increasing the aluminum core thickness will increase the height of its cells subjecting it to buckling phenomenon. Therefore, this study suggests that the optimal thickness of the aluminum honeycomb core should be 65% of the overall thickness of the sandwich beam to have the best impact resistance.

Aniruddha Sengupta
Professor, Indian Institute of Technology Kharagpur, India

Numerical Validation of Cyclic Triaxial Tests Conducted on Saturated Kasai River Sand

The idea of this study is to study the seismic performance of any structure resting or embedded in the ground up to some depth resting on saturated Kasai river sand subjected to dynamic loading. In order to do so, first some dynamic cyclic triaxial tests have been conducted on saturated Kasai river sand for different relative densities (Rana and Sengupta 2016). All these tests have been validated using a bounding surface plasticity model PM4 sand in FLAC 2D. As PM4 sand is a 2D plane strain model which does not take out of plane stress (Boulanger and Ziotopoulou 2016), total confining pressure of 100 kPa has been applied on top and sides with bottom fixed to simulate the results closer. One of the tests with deviator stress of 66 kPa has been completely validated in terms of stress-strain loops, pore water pressure ratio, effective stress paths, and its type of liquefaction (i.e., flow liquefaction, cyclic mobility, etc.) has been explained in complete detail. A very good match has been observed for these parameters. These calibrated parameters will be useful to study the behavior of structures on actual site.

Jagannadha Rao Subramanya Konathala
Senior Manager-Quality, Yongnam Engineering & Construction (Pte) Ltd, Singapore
Nagesh Bhadriraju
Adjunct Professor, Indian Maritime University, India
&
I. N. Niranjan Kumar
Director, Indian Maritime University, India

Application of Flux Cored Arc Welding (FCAW) without Pre-heating for Heavy Structures in Ship Building Fabrication & Construction of Heavy Offshore Structural Steels

In fusion welding processes, the reason often given to explain the need for preheating, controlling the inter pass temperature (in multi-pass welds), and post-weld heat treatment (PWHT) is to reduce the risk of cold cracking in the heat affected zone (HAZ). Cold cracking is a hydrogen embrittlement phenomenon, often referred to as hydrogen induced cracking or HAZ cracking. During the construction and fabrication of heavy offshore structures, several failures have been noticed during the welding of structures with higher plate thicknesses where preheating is not properly done. However, many welding engineers cannot readily arrange the preheating in offshore structures, oil and gas installations and in other locations where heavy ship building activities are being done. In this context, experimental studies have been performed on transient heat transfer in welding distortion control by using flux-cored arc welding process (Self Shielded-SS) without application of pre-heating as specified by the various welding international codes. The authors have studied various samples and tested them in which the FCAW welding has been done with and without preheat. The eight-step welding method enunciated by welding standards with preheating has been slightly modified into again eight step method without preheating and still obtained the same strength, toughness, hardness and stiffness. The use of tubular electrodes with very small diameters has extended the use of this process to work pieces of smaller section size. A main advantage of using flux-cored arc welding (SS) is the ease with which specific weld-metal things can be developed. By adding alloying elements to the flux core, virtually any alloy composition can be produced. The process is easy to automate and is readily adaptable to flexible manufacturing systems and robotics.

Nur Yazdani
Professor, The University of Texas at Arlington, USA

Non-Destructive Evaluation of FRP Laminate-Concrete Interface Bond with Surface Defects

Carbon Fiber Reinforced Polymer (CFRP) laminates have been successfully used as externally bonded reinforcements for retrofitting, strengthening and confinement of concrete structures. The adequacy of the CFRP-concrete bonding largely depends on the bond quality and integrity. The bond quality may be compromised during the CFRP installation process due to various factors. In this study, the effect of four such construction-related factors were assessed through non-destructive evaluation (NDE) methods, and quantification of the levels of CFRP debonding was achieved. The factors were: surface cleanliness, surface wetness, upward vs. downward application, and surface voids. A common unidirectional CFRP was applied to small scale concrete samples with factorial combinations. Ground Penetrating Radar and Thermography NDE methods were applied to detect possible disbonds at CFRP-concrete interfaces. Thermography was found to clearly detect all four factors, while the GPR was only effective for detecting the surface voids only. The thermal images over-predicted the amount of debonded CFRP areas by about 25%, possibly due to scaling errors between the thermograph and the sample surface. The maximum debonded CFRP area in any sample was about two percent of the total CFRP area. This is a negligible amount of debonding, showing that the factors considered are unlikely to significantly affect the laminate performance or any CFRP contribution to the concrete member strength or confinement.

Timothy M. Young
Professor and Graduate Director, The University of Tennessee, USA

Evolutionary Operation (EVOP) as Deduction Phase for Improving Machine Learning

Research in machine learning is rapidly increasing in recent years and is exemplified by more than 33,000 paper submissions on the topic to refereed journals in 2019. There appears to be a gap in the published research as related to the use of a traditional deductive method using the results of experimental design known as Evolutionary Operation or EVOP as an important precursor for machine learning algorithms. Machine learning algorithms belong to the kernel methods and are a class of algorithms for pattern analysis in the support vector machine (SVM). Machine learning algorithms are a class of 'greedy algorithms' that include regression trees, random forests, neural networks (NN), partial least squares (PLS), Bayesian Additive Regression Trees (BART), etc. Greedy algorithms have the tendency to over fit the training data set which weakens the validation of the predictions from the various models. Greedy algorithms also require higher dimensional data and variable reduction, e.g., genetic algorithms. We propose to use Evolutionary Operation (EVOP) which is a deductive designed experimental method as precursor for machine learning. The initial EVOP will reduce dimensionality put improve variable preselection and avoid the over fit problem associated with greedy algorithms. Results are presented on an EVOP analysis followed by modeling and predicting the modulus strength of engineered panels using regression trees, random forests, NN, PLS, Bayesian Additive Regression Trees (BART).

Marta Cristina Zaharia
Senior Scientific Researcher III, NIRD URBAN-INCERC, Romania

The Influence of the Coefficient of Acoustic Absorption of the Facades of the Buildings from the Street Profiles, on the Noise Level from the Urban Road Traffic

Considering the design of the urban assemblies from the point of view of the acoustic protection, in order to obtain an urban noise level that has values that fall within the provisions specified in the technical regulations in force regarding the acoustics of constructions and the urban acoustics, for the configuration of the transverse profiles of the bordered traffic arteries of building fronts, of special importance also has the judicious design of the facade construction elements, because by the values of the acoustic absorption coefficients of the materials / products of the facades of the buildings that border the cross-sectional profiles, the value of the noise level can be influenced from the urban road traffic, received at the receiver. In the case of the design from the point of view of the urban acoustics of the facade elements of the buildings that border the transverse profiles of the traffic roads, the establishment of the use for finishing some types of construction materials / products is made according to their acoustic absorption characteristics, respectively of the coefficient of acoustic absorption, so as to obtain a diminution of the propagation by reflection, between the fronts of buildings, of the urban noise coming from a source of traffic, to the receiver situated in the building or in the external environment, in a point of the transverse profile of the traffic artery. The method of calculating the street noise level, at one point, is very complex and contains a multitude of variable parameters of the street profile, among which a parameter depends on the average acoustic absorption coefficients of the facades of the delimiting buildings. To highlight only the influence of the noise absorption coefficients of the facades of the buildings that border the cross-sectional road profiles, on the noise level from the urban road traffic, in the researches carried out by calculation, for the specific situation considered of the street-study profile – there were made changes only of the values of the acoustic absorption coefficients, considering by study variants (cases) with several types of building materials / products for finishing the facades of buildings. Research was performed by analyzing the sound absorption properties, for 6 types of structures (materials / products) of constructions that can be used to finish the facades of buildings. Calculation studies regarding the values of the equivalent noise level, Lext (f), from traffic, –which

were performed for a street-study profile, considered as a standard, then for 6 cases of study-road profiles, it shows that for a traffic lane of technical class 1 (with 8 lanes of traffic), bordered by two fronts of buildings of at least 8 floors high, paved with asphalt, without trees and with a complex composition of traffic (7 types of traffic means)-, indicates that values can be obtained that differ with up to 15 dB, from 69 dB (A) to values of 84 dB (A), depending on the types of materials / construction products (respectively their specific sound absorption coefficients), used to finish the facade walls of the buildings that border the transverse road profiles. So, in the case of facades with absorbing material, the transmission of traffic noise, inside a building, is greatly diminished.