UNSW SYDNEY

CIES – Centre for Infrastructure, Engineering & Safety
Civil & Environmental Engineering

Annual Report 2019

CRICOS Provider No.00098G

ADDRESS

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Cricos Provider Number: 00098G

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Our Centre

Our People

Our Research

Our Vision

As an internationally recognised research centre, our vision is to improve the sustainable design, construction and maintenance of economic, effective and safe civil engineering infrastructure to enhance the quality of human life.

About Us

We conduct pure and applied research...

CIES was established as a UNSW research centre in January 2007 to facilitate advanced research in all aspects of civil engineering infrastructure, including building structures, bridges, tunnels, roads, railways, pavements and materials.

At CIES, we apply our skills to engineering and safety assessments of infrastructure. We look at the risk management of buildings, bridges, dams, roads and other infrastructure when subjected to both in-service conditions and overload (or limit) conditions, such as in fire, earthquake, cyclone or blast situations, or when structures are exposed to hostile environments.

The core activities of the Centre are underpinned by a significant number of eminent academic staff of international renown in their respective fields, particularly in structural engineering, geotechnical engineering, advanced materials engineering, pavement engineering, engineering mechanics, computational mechanics and in laboratory testing.

We conduct pure and applied research with funding won from national competitive granting schemes (particularly through the Australian Research Council's Discovery and Linkage Project Schemes) as well as other contestable funding programs, and with direct support from industry.

We also undertake commercial activity in collaboration with industry that is challenging and strategic in its nature. These research and commercial activities are conducted with essential physical resources, such as those of the Heavy Structures Research Laboratory, Advanced Materials Research Laboratory, Geotechnical Laboratory and our Advanced Computational Analysis Laboratory (ACAL).

Multi-disciplinary collaboration for the best results

CIES projects incorporate a number of engineering disciplines – from structural engineering to geotechnical engineering, and engineering materials to computational mechanics.

In short, CIES offers:

- World-class interdisciplinary research by a team made up of structural and geotechnical engineers and scientists.
- Access to advanced analytical, computational and experimental techniques and facilities.
- A forum for idea exchange and research collaboration between engineers and scientists.
- The ideal base from which to develop industry proposals and grant funding applications.
- Industry partnerships to secure the practical application of research outcomes.
- Opportunities for postgraduate students in a wide range of relevant disciplines.

Executive Committee

The UNSW Centre for Infrastructure Engineering and Safety is managed by an Executive Committee comprising of the CIES Director, Research Director, Deputy Director and the Centre Manager. The committee met on a regular basis to discuss strategy, performance and research opportunities. In addition, input to CIES management is provided by the CIES Academic Group.

Director
Professor Chongmin Song

Research Director
Professor Mark Bradford

Deputy Director
Associate Professor Adrian Russell

Centre Management
Theresa Wisniewski

Steering Committee

The Steering Committee meets throughout the year to oversee and monitor the progress of the Centre and to assist the Director in developing strategies to ensure that the goals and objectives of the Centre are realised. The membership of the Management Board for the Centre is:

- Professor Mark Hoffman, Dean, Faculty of Engineering (Chair)
- Professor Stephen Foster, Head of School, Civil & Environmental Engineering
- Professor Chongmin Song, CIES Director
- Professor Mark Bradford, CIES Director of Research
- Associate Professor Adrian Russell, CIES Deputy Director
- Professor Klaus Regenauer-Lieb, School of Minerals and Energy Resources Engineering
- Scientia Professor Deo Prasad, Chief Executive Officer, CRC for Low Carbon Living
- Professor Ismet Canbulat, School of Mineral and Energy Resources Engineering
- Mrs Theresa Wisniewski, CIES Centre Manager

Industry Advisory Committee

The CIES is supported by an Industry Advisory Committee comprising of 12 members from industry and government organisations. The committee meet regularly with CIES academics to promote the engagement of CIES with Industry.

Civil and Environmental Engineering
Centre for Infrastructure and Safety (CIES)
Organisation Chart

Chongmin Song
Director CIES

Theresa Wisniewski
Centre Manager

Engineering Construction and Management

Johnson Shen
Senior Lecturer

Steve Davis
Senior Lecturer

Robert Holdom
Senior Lecturer

David Carmichael
Professor

Ailar Hajimohammadi
Senior Lecturer

Alireza Kashani
Lecturer

Khalegh Barati
Associate Lecturer

Souradeep Gupta
Research Associate

Geotechnical Engineering

Nasser Khalili
Professor

Adrian Russell
Professor
Deputy Director

Kurt Douglas
Senior Lecturer

Arman Khoshghalb
Senior Lecturer

Babak Shahbodagh
Lecturer

Thanh Liem Vo
Research Associate

Asal Bidarmaghz
Lecturer

Mahammad Vahab
Research Associate

Structural Engineering

Stephen Foster
Professor
Acting Dean

Joshua Xiao Lin Zhao
Professor
Associate Dean

Mario Attard
Associate Professor

Wei Gao
Professor

Ahsan Parvez
Postdoctoral Fellow

Yinglei Li
Postdoctoral Fellow

Xiaojun Chen
Research Associate

Yuguo Yu
Research Associate

Ehab Hamed
Associate Professor

Hamid Valipour
Associate Professor

Mark Bradford
Professor
Research Director

Elena Atroshchenko
Senior Lecturer

Ulrike Dackermann
Lecturer

Taehwan Kim
Lecturer

Sascha Duczek
Lecturer

Mehrisadat Makki Alamdari
Lecturer

Daniel O'Shea
Associate Lecturer

Allen Chhor
Senior Research Associate

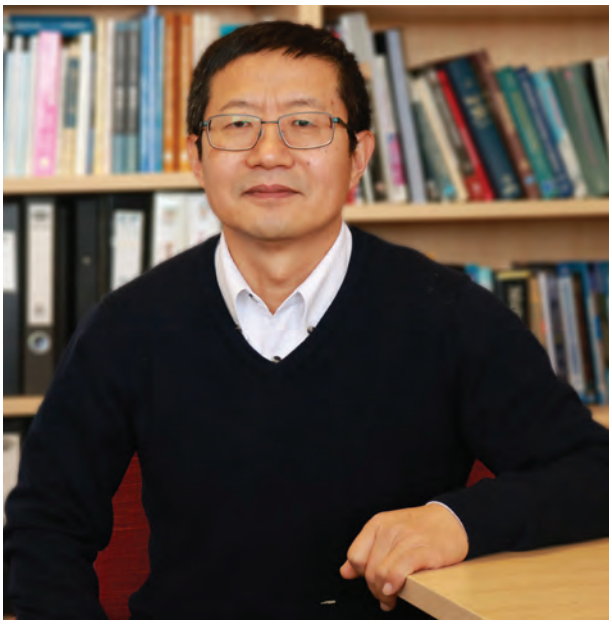
Junqi Zhang
Research Associate

WeiWei Xing
Research Associate

Last updated: 15/01/2020

Welcome from the Director

This report provides an overview of the progress of projects funded by competitive national schemes and industry, and the publications produced by staff and students throughout 2019



I am proud to present this annual report on our achievements at the Centre for Infrastructure Engineering and Safety (CIES) during 2019. The report outlines the mission of the centre, its governance structure and finances. This report provides an overview of the progress of projects funded by competitive national schemes and industry, and the publications produced by staff and students throughout 2019.

You will see an overview of our teams' impressive accomplishments during 2019 within this annual report. Collectively our members have secured over $2M research funding, graduated 21 PhD students and published 115 refereed journal papers. In December, the highly competitive Australian Research Council (ARC) Discovery Grants for projects starting from 2020 were announced. CIES staff secured three grants totalling $1.23M.

Six new core academic members joined CIES in 2019, broadening our interests and further strengthening the team. We had the great pleasure to welcome Professor Joshua Zhou, Dr Elena Atroshchenko, Dr Asal Bidarmaghz, Dr Sascha Eisentrager, Dr Ailar Hajimohammadi and Dr Ali Kashani.

We are delighted to celebrate the promotion of Associate Professor Adrian Russell to Professor with effect 1 Jan 2020. In 2019 we farewelled Associate Professor Arnaud Castel.

On behalf of the Executive Committee, I would like to thank all our staff and students who contributed so generously to the continuous success of the Centre. I would also like to express my sincere appreciation and thanks to our industry partners and advisory committee members for your strong support and contributions.

Professor Chongmin Song

Centre Director

CIES IAC Industry Members 2019

Our accomplished and dedicated Industry Advisory Committee meets regularly with CIES academics to further promote our engagement with Industry.

Garry Mostyn
Chair
Principal, PSM

Garry Mostyn graduated from UNSW Australia in civil engineering in 1973. He subsequently completed a master's degree in geotechnical engineering at UNSW and a bachelor's degree in geology and statistics at Macquarie University. He worked as a cadet and engineer with the NSW Department of Public Works and with consulting geotechnical engineers from 1970 until 1986. He then joined the Department of Civil Engineering at UNSW Australia where he lectured in civil and environmental engineering practice and geotechnical engineering. He joined PSM in 1997 as a Principal Consultant while retaining a part time appointment at UNSW.

Garry's fields of specialist expertise include slope engineering; foundation engineering; rock mechanics; geotechnical risk analysis; and forensic engineering. He has authored or co-authored over 80 journal and conference papers. He has worked on major projects throughout Australia and in Thailand and PNG. He has been an active member of several national and international code and practice committees and been involved at the highest levels of the Australian Geomechanics Society and the International Society for Rock Mechanics.

James Aldred
Technical Director - Concrete Future/AECOM and Adj A/Professor - UNSW Civil & Environmental Engineering

James has over 30 years' experience in the concrete industry in Australia, Asia, the Middle East and the United Kingdom. His background includes Technical Director of an international admixtures company, Manager of the High-Performance Concrete Research Group at the National University of Singapore, Technical Manager of Taywood Engineering and Honorary Research Fellow at Imperial College. He is a specialist in concrete technology including mix design, durability, investigations and advice, with a proven record of helping change industry mindset and practices. He was the Independent Verifier for the Burj Khalifa in Dubai which is the world's tallest tower.

James obtained his PhD from Curtin University. He is a Chartered Professional Engineer and a Fellow of the Institute of Engineers Australia, the American Concrete Institute and the Institute of Concrete Technology. James has received the Award of Excellence from Concrete Institute of Australia and the Award for Outstanding and Sustained Contributions to Concrete Technology by ACI International Conferences, as well as the prestigious George Stephenson Medal from Institute of Civil Engineers.

Phil Blundy
Technical Director, AECOM and Immediate Past Chair Engineers Australia, Structural College Board

Phil has nearly thirty years industry experience, at Hyder Consulting, then Cardno, and most recently at AECOM. As Technical Director at AECOM he has worked on projects for all levels of government and private agencies. Phil has been a member of Engineer Australia's Structural College Board for over ten years and is the Immediate Past Chair. He has been particularly involved in research and promotion of Australian Bridge Design Standards

Dr Murray Clarke
Director, Structural Engineering APAC, Dematic, FIEAust CPEng NER APEC Engineer IntPE(Aus)

Dr Murray Clarke is Director of Structural Engineering at Dematic, a global engineering company that designs, builds and supports logistics solutions that optimise material and information flow.

After completing his PhD at the University of Sydney, Murray joined the academic staff to carry out teaching and research into steel structures, also at the University of Sydney. During this time he published widely in the field of advanced structural analysis and design of steelstructures.

Murray moved to Dematic in 1999 to initiate the core discipline ofstructural engineering in that organisation. The main fields of Murray's current work include the design of storage racking and associated steel structures such as mezzanine floors to support Dematic's automated systems projects across the Asia Pacific region. Storage racks range in height from a few metres to more than 40 m and make extensive use of cold-formed steel. In his current role, Murray has been fortunate to blend his academic interests with practical design and he maintains an active role in developing automated design tools for rapid and precise design of racking structures. Murray was a member of Standards Australia committee BD/62 responsible for developing AS 4084-2012 _Steel Storage Racking_ and is also a registered technical engineer with the European Racking Federation, a European industry body that develops design codesfor the storage equipment industry in Europe

Kathy Franklin
Associate Principal- ARUP

Kathy has worked on the structural design, analysis and forensic engineering on a wide variety of building and infrastructure projects. Her particular interest and expertise is in structural dynamics (vibration, blast, impact, seismic engineering), solving such problems as design for dancing crowds in pop concerts, pedestrian bridge vibration, lively office floors, achieving low vibration environments for sensitive equipment in laboratories and hospitals, wind, vehicle and machine induced vibration of structures. Projects that she is particularly proud to have been involved with include: Singapore Sports Hub, Kurilpa Bridge Brisbane; Marina Bay Sands Skypark; Sydney Cricket Ground Victor Trumper and Noble Bradman Stands; and "The Birds Nest" Beijing National Stadium. Kathy is passionate about education of the next generation of engineers, and research that will improve delivery of future projects. She regularly guest lectures at UTS, UNSW and USyd and has participated in a number of joint industry/academia research projects.

Jim Forbes
Chairman Australian Standard Committee BD-002

Jim is Chairman of Australian Standard committee BD-002, responsible for AS 3600, the Australian Concrete Structures Code, and represents Australia on the International Standards Organisation TC71 committee.

With over 50 years in the construction industry, Jim has been involved with the planning, design, coordination and supervision of a wide variety of civil engineering and building projects.

His expertise covers Concrete Structures, Tall Buildings, Mining, Aerospace and Transport Infrastructure. Having developed considerable experience in transport projects, he applies a unique blend of building and transport skills to public and private transport projects across Australia

His broad experience in civil engineering has seen him involved in projects which require holistic solutions to complex engineering, transportation and planning challenges. These have typically involved major infrastructure development projects, from initial master-planning to completion.

Jim has extensive experience in running multi-disciplinary teams and has an enviable reputation for identifying the winning elements of Design and Construct projects.

His acknowledged expertise in concrete and concrete structures led him towards a strong involvement with the Concrete Institute of Australia and the Federation Internationale du Beton and he has served as President of each of these organisations.

Sam Henwood
Director Pavements and Geotechnical Transport for NSW

Sam has been practising as a geotechnical engineer since graduating from UNSW in 1994 having worked extensively in both Australia and the United Kingdom in both the private and public sectors. Since 2016, he has led the Transport for NSW (formally Roads and Maritime Services) Pavement and Geotechnical section in his current role as Director Pavements and Geotechnical. He is responsible for 55 professional staff with 5 direct reports and manages technical risk in pavements, geotechnical engineering, geoscience and materials disciplines. Sam is the Transport for NSW representative on the Austroads Pavement Task Force, managing technical development in pavement engineering. Sam has taken a lead in the use of recycled materials in road construction.

Prior to joining Roads and Maritime Sam worked as a consultant. He was responsible for the successful completion and management of geotechnical projects and has experience of geotechnical interpretation and design, pavement design, drainage design, client liaison, resource allocation, project planning, quality control and financial accountability.

He has worked on major infrastructure projects including highways, rail and ports, residential and commercial developments, local roads and tailings dam design. He has extensive experience in the UK rail sector particularly in Scotland and northern England.

He has also spent his formative years in an earthworks testing laboratory.

Peter Key
National Technical Development Mgr., Australian Steel Inst.

Dr Peter Key is a structural engineer with upwards of 25 years' experience in R&D, design, site supervision and project implementation in a design & construct scenario for large steel buildings. His specialties include 3D design, structural design, research & development in construction. His interests have always encompassed the use of IT to bring efficiencies to the AEC industry.

Peter is Australian Steel Institute's National Technical Development Manager and a regular presenter on steel design and construction. He is part of Standards Australia Committee BD-001 responsible for the new AS/NZS 5131 Steel structures - Fabrication and erection. He has also written a range of technical publications including the Structural steelwork fabrication and erection Code of Practice on which AS/NZS 5131 is based.

Rod McKay-Sim
Director, Hillside Engineering Pty Ltd
Member, Concrete Institute of Australia

Rod has been involved in engineering innovation all his professional career. In the 1990s he grew a small agency based company from less than $500K turnover to a strong, profitable business of sales exceeding $30million and operations throughout Australia, New Zealand and Singapore by introducing six ground-breaking engineering technologies (now considered standard practice) in Australia and New Zealand: Since 2006 he has led his own company in innovative research and practise - professional specialties are Concrete Lifting and Anchoring Systems design and technology, Tilt-Up construction systems, and Pre-cast concrete lifting systems. Since 2003 Rod has also been a keen cyclist for charity, five times finisher in the Hartly Challenge (Canberra-Charlottes Pass-Canberra) raising money for Hartley Lifecare - helping disabled people lead happy and productive lives, and a regular in the Sydney to Surfers cycle ride, raising money for Youth Off the Streets.

John Merrick
Snr Tech Director ARCADIS Aus. Pacific
METRON - Barangaroo Stn Design Mgr

John has over 20 years' experience in various types of structures including residential, commercial, retail, educational, health, recreational, stadiums and transport infrastructure in Australia and overseas. He has presented papers at engineering conferences both in Australia, United Kingdom and USA. John is a committee member on BDS - 032 - Composite Structures and BDS-01 Steel Structures.

Some of John's projects include METRON - Underground Station Design and Technical Services (USDTS) Sydney Metro project; West Connex - Building Zone Manager - Responsible for the structural, civil and building services design for all buildings in Stage 1B including 3 ventilation stations, 6 substations, MMC office building, 2 fire pump buildings and 4 tolling buildings;. Barangaroo South -6 storey commercial and 4 storey mixed usage buildings; Australian Embassy in Kathmandu and New Delhi - detailed inspections following 2015 earthquake; Dubai Tower Doha Project manager and design engineer for 88 storey tower currently under construction; Al Harma Tower - project manager for peer review of 413m tower in Kuwait; Port of Townsville - design manager for berth expansion; Inghams Sommerville - design of new steel industrial buildings.

Anna Paradowska
Industry Engagement Manager Australian Centre for Neutron Scattering, ANSTO
Conjoint Professor in Advanced Structure Materials Syd Uni

Dr Anna Paradowska is Industry Engagement Manager at the Australian Centre for Neutron Scattering, ANSTO as well as a conjoint Professor in Advanced Structure Materials at the University of Sydney.

Anna's current main focus is to manage the Australian Centre for Neutron Scattering -Industrial Liaison Office at ANSTO. Her vision is to promote the Centre's innovation and expertise, connecting business and industry to the Centre's ground-breaking research and modern neutron technology, to support and make a positive impact on Australian and global industry.

Her specialties include: materials characterisation, in particular neutron and synchrotron residual strain/stress measurements in various materials; and the influence of residual stress on materials performance and to relate them to design or/and manufacturing procedures as well as integrity requirements.

Warren South
Director- Research & Tech Services at Cement Concrete & Aggregates Australia

Dr Warren South has worked in the heavy construction materials industry for the past 35 years. He started his working career in cement in 1985 with Blue Circle Southern Cement at Berrima as Assistant Works Chemist, later to become Works Chemist in 1989. During this time he worked on the development of cement and concretes specifically for high durability applications such as the immersed tube units for the Sydney Harbour Tunnel and other important infrastructure projects. As Technical Manager for NZ's Golden Bay Cement he led the development of cements specifically for use in the South Pacific, and the development of inorganic polymer binders for concrete. He gained his doctorate in Civil Engineering from the University of Wollongong in 2010, dealing with the performance of cements based on natural pozzolanic materials available in New Zealand. Warren maintains an active focus on addressing sustainability and resilience in terms of the cement and concrete industry and is a strong advocate for the positive contributions that concrete can make to the durability of the built environment.

CIES Staff Members of the IAC

Professor Chongmin Song, Director, CIES

Professor Wei Gao

Professor Stephen Foster

Associate Professor Adrian Russell, Deputy Director, CIES

Professor Mark Bradford, Research Director, CIES

Associate Professor Ehab Hamed

Associate Professor Hamid Valipour

Professor Nasser Khalili

ARC Grants

Three CIES ARC Discovery Project grants awarded in 2019

The Federal Government Australia Research Council ARC's Discovery funding schemes recognise the importance of fundamental research to the national innovation system.

The national innovation system includes the people (for example, in government, higher education and business), processes and relationships involved in 'new' knowledge in a knowledge-based economy.

A strong capability in fundamental research (sometimes called discovery, basic or blue sky research) will result in the development of new ideas, the creation of jobs, economic growth and an enhanced quality of life in Australia.

The Discovery Program aims to deliver outcomes of benefit to Australia and build Australia's research capacity through support for:

- excellent, internationally competitive research by individuals and teams;
- research training and career opportunities for the best Australian and international researchers;
- international collaboration; and
- research in priority areas.

In 2019 CIES was proud to received three of these prestigious research grants, with a total of $1.23M.

Mixed Mode Torsion-Shear-Bending Failure in SFRC Elements.

Chief Investigator: Professor Stephen Foster

DP200103764 - $384,481

Summary: In 2017 and 2018 the Australian Standards for the design of concrete bridges and structures were released; these are some of the first in the world, to include design procedures for steel fibre reinforced concrete (SFRC) in a comprehensive way. While rules have been introduced for shear and bending of SFRC girders, the rules exclude the use fibres to carry torsional moments. This study investigates the torsion-bending-shear interaction performance of SFRC members. The study will provide vital data needed for adoption by engineers and Standards bodies.

Time Dependent Behaviour of Fibre Reinforced Concrete Structures.

Chief Investigators: Emeritus Professor Raymond Ian Gilbert (CIES) and Dr Ali Amin (USyd)

DP200102114 - $411,161.00

Summary: The project aims to quantify the initial and long-term cracking and deformation of fibre reinforced concrete structures such as tunnel linings and slabs under sustained in-service loads and conditions. Concrete structures with and without conventional steel reinforcement and containing either steel or polypropylene fibres mixed in the concrete will be tested experimentally and modelled analytically and numerically. Expected outcomes are benchmark experimental data on structural behaviour under sustained loads, development of reliable simulation models and robust design procedures for the control of time-dependent cracking and deformation in fibre reinforced concrete, with reduced maintenance costs and more sustainable concrete structures.

Computational Fracture Analysis of Structures and Materials.

Chief Investigator: Professor Chongmin Song

DP200103577 - $430,601.00

Summary: This project aims to develop a computer simulation technique to address the safety of engineering structures. A novel numerical framework based on the scaled boundary finite element method will be developed to model the fracture process critical to assessing structural integrity. The expected outcomes of this project include an innovative technology for numerical simulation and improved capabilities to generate high-fidelity predictions of structural safety at minimum human efforts. The fully automatic and robust numerical tool developed in this project will help engineers and government authorities to perform safe and cost-effective design and management of engineering structures that are vital to modern economies.

ARC Linkage

2019 ARC Linkage Projects coordinated through other universities

Professor Yu Bai (Monash University); Dr Mehrdad Arashpour; Professor Xiao Lin (Joshua) Zhao (CVEN – UNSW); Dr Wenchi Shou; Mr Tai Hollingsbee; Professor Lawrence Bank:

LP180101080 - Structural assembly for remote housing using fibre reinforced composites.

Partner Organisations: NORTH CO SYSTEMS PTY LTD

Funding: $420,000

Summary: This project aims to address construction challenges in remote housing by off-site manufacturing and on-site assembly using fibre reinforced composites and digital made-to-measure approach. Its goal is to generate interdisciplinary knowledge and practical technologies for reliable, affordable and durable housing in remote harsh environments. Intended results include innovative connections and systems with valuable understanding of their performances under various loading scenarios and accurate digital visualization for remote construction. The outcomes expect to unlock remote development, enhance our competitive strengths for manufacturing and construction industries, and further offer new solutions in post-disaster recovery applications.

CIES Awards & Achievements 2019

Congratulations to all our staff and students on their many achievements and awards in 2019 including the following:

Ian Gilbert – the busy (extremely) retiree!

CIES legend, Ian Gilbert received the inaugural UNSW Emeritus Award 2019 for his significant contributions to the university.

The Award was established by UNSW in order to acknowledge and celebrate the achievements of those Emeriti who have continued to contribute in significant ways to the university. An award spokesperson Andrew Hall, from UNSW's Division of Philanthropy said they were "incredibly impressed by the breadth of work done by Ian Gilbert". And looking at Ian's achievements since he became an Emeritus Professor in 2010, it's not hard to see why.

Ian was the Deputy Director of CIES from 2007 until 2018. Since 2010 he has been the author or co-author of 6 books, four of which are text books used both in Australia and overseas in under-graduate and post-graduate courses in structural engineering : Design of Prestressed Concrete to Eurocode 2, (2017); Design of Prestressed Concrete to AS3600-2009, (2016); Structural Analysis: Principles, Methods and Modelling, (2015); Solution Manual for Structural Analysis: Principles, Methods and Modelling, (2015) - all published by CRC Press (Taylor & Francis Group), Florida, USA.

Ian has also published 56 refereed journal papers and 71 refereed conference papers since 2010, and supervised or co-supervised 9 PhD students to completion. He continues to mentor more junior academic staff and post-graduate students in the structural engineering group within the School of Civil and Environmental Engineering at UNSW.

Research Influence

Professor Gilbert's research on the time-dependent deformation of concrete structures has been incorporated into the 1988, 2001, 2009 and 2018 editions of the Australian Standard for Concrete Structures AS3600, in particular the clauses relating to design for deflection control, crack control and creep and shrinkage modelling. As such, Professor Gilbert's research has influenced and will continue to influence the in-service performance of concrete structures designed and constructed in Australia in the last 30 years and in the foreseeable future.

He is the UNSW Representative, and longest serving member, on Standards Australia's Committee BD-002 responsible for the development of the Australian Standard for Concrete Structures AS3600 (1980-present), and the only Australian representative on the main committee of the American Concrete Institute ACI-318 responsible for the development of the American Concrete Structures Code of Practice (2012-2019).

Ehab Hamed -
Australia-China Young Scientists Exchange

CIES Associate Professor Ehab Hamed was awarded the 2019 Australia-China Young Scientists Exchange Programme (YSEP)

The program is a joint governmental initiative funded by the Australian Department of Industry, Innovation and Science and the Chinese Ministry of Science and Technology. It is supported by the Australia-China Strategic Research Fund.

YSEP funds an annual exchange of Australian and Chinese early to mid-career researchers in the fields of science, technology and medicine. A/Prof Hamed, a structural engineer, was among the 16 researchers in Australia who were awarded this program.

CIES Director, Professor Chongmin Song said it was “a real recognition of Ehab’s outstanding work and committed scholarship.”

This prestigious program aims to:

- Increase early to mid-career Australian and Chinese researchers’ understanding of the cultures, particularly the science and research practices and systems, of the two countries
- Develop the participants’ leadership skills as future “science ambassadors” for Australia and China
- Provide a catalyst for long-term, sustainable Australia-China research collaboration

Associate Professor Hamed travelled to China in October 2019 visiting Tsinghua University, Tongji University and Shanghai Jiao-Tong University. He undertook an individual program of research-related visits, meetings, seminars, workshops and symposia.

Hamed’s main research interests include the viscoelastic behaviour of materials and structures; Strengthening of structures with FRP composite materials; Sandwich panels and Precast concrete structures

Japan awards
Dr Mehri Makki Alamdari

In 2019 CIES academic Dr. Mehrisadat (Mehri) Makki Alamdari was awarded the prestigious award from JSPS (Japan Society for Promotion of Science) to do research in Japan.

Dr. Makki Alamdari is an expert in structural health monitoring, vibration analysis and testing, inverse dynamic problems and signal processing.

During her stay in Japan, at the Infrastructure Innovation Engineering Centre, Department of Civil and Earth Resources Engineering at Kyoto University, Mehri closely collaborated with **Professor C. W. Kim,** a world-recognised expert in the field of Bridge Health Monitoring at Kyoto University, to develop an advanced drive-by bridge inspection technology using mobile sensing.

This research aims at developing a robust framework for monitoring of bridges in service to evaluate their long-term performance. The main goal is to develop a generic classification system comprised of a feature extractor and a classifier in order to detect, localise and assess any structural change in the bridge solely from the response of the vehicle moving over the bridge.

An award-winning scholar, Mehri is on the Executive of the Australian Network of Structural Health Monitoring (ANSHM), 2017 and a member of The International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII). Prior to joining UNSW, she was a research fellow in Data61|CSIRO working on structural health monitoring of the iconic Sydney Harbour Bridge.

The **Japan Society for the Promotion of Science** is an Independent Administrative Institution, which plays a pivotal role in the administration of a wide spectrum of Japan’s scientific and academic programs.. Supported in large part by annual subsidies from the Japanese Government, JSPS’s main functions are: To foster young researchers: To promote international scientific cooperation: To award Grants-in-Aid for Scientific Research: To support scientific cooperation between the academic community and industry, and to collect and distribute information on scientific research activities.

Young Researchers Award for
Mohammad Khoshini –
avoiding over costly designs.

Congratulations to CIES PhD candidate in geotechnical engineering Mohammad Khoshini for winning the 2019 Australian Geomechanics Society (AGS) NSW Young Researchers Award.

Each year the Sydney and Newcastle Chapters of the AGS offer this prestigious **AGS NSW Research Award** for research in Geotechnical Engineering or Engineering Geology. The award aims to provide a forum for NSW enrolled research students to showcase their research to the wider geotechnical community. The Prize includes $2,000 and the opportunity to publish in the **AGS Journal Australian Geomechanics**.

Selection criteria for the Award included technical content, originality of content, industry relevance and clarity of written and verbal communication. Mohammad Khoshini's submission shone on all counts.

Mohammad's research topic was "Experimental investigation and constitutive modelling of weak rocks subject to mechanical and moisture degradation".

The work is part of an ARC funded Linkage Project aimed at advancing experimental, theoretical and computational bases for the mechanics of weak rocks. The industry partners of the project are Roads and Maritime Services (RMS), and Pells, Sullivan & Meynink (PSM) Consulting.

"By incorporating our findings on the behaviour of weak rocks," Mohammad says, "confidence in design methods will be increased to the point that costly over-designs can be avoided.

Billions of dollars are expended each year across Australia building infrastructure. High rates of infrastructure spending are expected to continue to meet the needs of Australia's growing population, which is expected to double by 2060.

Even a conservatively estimated 5% increase in efficiency arising from contributions of this project and improved safety dealing with marginal materials will save infrastructure owners, government and private, tens of millions of dollars each year."

Mohammad wished to especially thank his supervisors at CIES, Professor Nasser Khalili and Dr Arman Khoshghalb for their generous and insightful support during the course of his research.

Award for
Dr Mahdi Babee –
in pursuit of more sustainable and durable concretes.

CIES is delighted to congratulate our recent PhD graduate **Dr Mahdi Babaee** who has been awarded the **Concrete Institute of Australia**'s National Engineering Bursary Award for 2019.

The Bursary is a biennial award made to post graduate students studying engineering, chemistry, materials science, building science and other relevant subjects which contribute to the research knowledge base of concrete in Australia. The award is made for excellence in thesis work on concrete and cement based products and processes.

Dr Babaee graduated from UNSW in 2018 following the completion of his thesis entitled "Corrosion of Reinforcement in Alkali-Activated Materials" which was supervised by CIES Associate Professor Arnaud Castel and Associate Professor Hamid Vali Pour.

The increasing demand for sustainable concretes has promoted the development of a category of alternative binders called alkali-activated binders, including materials described as geopolymers, which are produced by the reaction of solid precursors such as fly ash, slag, and metakaolin with alkaline solutions.

As buildings and infrastructures are aging nowadays, the durability aspects of concrete have become more important than in the past, and despite the acceptable mechanical properties of alkali-activated concretes, there are some concerns over their durability and service life as they were brought into service very recently.

Babaee's dissertation investigated various influential parameters involved in the initiation and propagation phases of corrosion of reinforcements in alkali-activated materials, as one of the main causes of deterioration of the concrete structures.

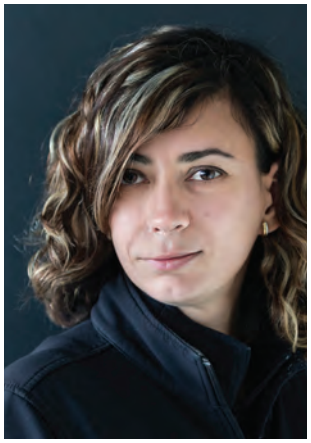
Babaee's research work was undertaken as part of the current CIES and industry pursuit of more sustainable and durable concretes.

David Millar, Chief Executive Officer advised that while the quality of the submissions was extremely high, and the Institute's judging panel found it an extremely difficult task to split them all, they unanimously selected the thesis by Dr Babaee as the winner of the 2019 Bursary.

Mahdi now works in industry where he remains an advocate of employing new sustainable materials in the construction industry. He is well-recognised internationally for his pioneering works on developing low-embodied-carbon concretes such as geopolymers. His published research is significantly influencing models and concrete standards in Australia and around the world.

CIES Promotions 2019

Congratulations to CIES academics Mehri Alamdari and Adrian Russell for their so well-deserved promotions in 2019.



In 2019 Dr Mehrisadat (Mehri) Makki Alamdari was promoted from postdoctoral research fellow to Lecturer in the UNSW School of Civil and Environmental Engineering. She is an expert in structural health monitoring, vibration analysis and testing, inverse dynamic problems and signal processing. She is the winner of the prestigious JSPS Award (Japan Society for Promotion of Science). An award-winning scholar, Mehri is on the Executive of the Australian Network of Structural Health Monitoring (ANSHM), and a member of The International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII). Prior to joining UNSW, she was a research fellow in Data61|CSIRO working on structural health monitoring of the iconic Sydney Harbour Bridge

In 2019 Deputy Director of the Centre for Infrastructure and Engineering Safety (CIES), Associate Professor Adrian Russell became a Professor in Geotechnical Engineering in the School of Civil and Environmental Engineering at UNSW.

As a geotechnical engineer, Russell looks to understand how infrastructure such as buildings, foundations, tailings storages, roads, tunnels, bridges, railways and ports interact with the ground. His research interests include soil mechanics, rock mechanics and the mechanics of fibre reinforced geomaterials and their use in infrastructure to increase strength and failure resistance. Able to recognise the value of academic-industry partnerships, a number of his research ideas have been successfully implemented within industry including the development of a new type of soil-cement-fibre mix technology for use in retaining wall systems to reduce cost and embodied carbon in partnership with Wagstaff Piling Pty Ltd, and the development of a technique to prevent blockages in ore passes in partnership with Glencore Pty Ltd.

A natural teacher, Russell brings innovation into the classroom with a more creative approach to teaching engineering design. Encouraging students to reach beyond the standard texts for an answer and utilise new technologies while maintaining an understanding of basic concepts is key to developing a more innovative approach to problem solving. Russell's love of teaching extends outside the university classroom. He also delivers the travelling workshop 'Unsaturated soil mechanics for practicing engineers' to industry professionals on behalf of the Australian Geomechanics Society.

CIES Grants 2019

UNSW Investigators	Project Title	Sponsor Name	2019 Amount
Bradford, MA	Buckling capacity of high-strength steel flexural members	Australian Research Council / Discovery Project	130000
Bradford, MA	The National Key Laboratory of China for Disaster Reduction in Civil Engineering	Tongji University / International Contract	49333
Foster, SJ ; Parvez, MA	Milestone report - Review of total outputs completed and low carbon materials, products and designs for large scale residential and commercial buildings with supporting IT design tools implemented.	CRC For Low Carbon Living Limited / Research Grants	7550
Gao, W	New generation of sustainable building structures	Beijing Engineering Research Center / International Contract	120000
Gao, W Li, G Zhang, Y	ARC Research Hub for nanoscience based construction material manufacturing (Project 1)	Monash University / ARC Industrial Transformation Research Hub Shared Grant & Shared Industry Partner contributions	68293
Gilbert, RI	Shrinkage, cracking, self-healing and corrosion in blended cement concrete	Australian Research Council / Linkage Project- Industry Partner CEMENT CONCRETE & AGGREGATES AUSTRALIA	154000
Hamed, E	Coupled service and ultimate behaviour of high strength composite columns	University of Sydney / ARC Discovery Project Shared Grant	30000
Kashani, A	Melbourne University Lightweight Concrete R&D Grant Project	University of Melbourne / Sustainability Victoria Research and Development Grant Shared Grant	20000
Kashani, A	Concrete Road Barriers Project	University of Melbourne / Tyre Stewardship Australia Research Grant Shared Grant	20000
Khalili-Naghadeh, N	Warragamba Dam Raising - Soil Testing	GHD PTY LTD / Water NSW Subcontract	2000
Khalili-Naghadeh, N Khoshghalb, A	Non-isothermal dynamic strain localisation in unsaturated porous media	Australian Research Council / Discovery Project	95000
Khalili-Naghadeh, N; Russell, A	Modelling creep and time-dependency in unsaturated soils	Australian Research Council / Discovery Project	100000
Khalili-Naghadeh, N; Russell, A	Experimental investigation and constitutive modelling of reactive soils	Australian Research Council / Linkage Project Industry Partner Contribution - PSM Consult Pty Ltd & Department of Planning, Transport and Infrastructure (SA)	155960

UNSW Investigators	Project Title	Sponsor Name	2019 Amount
Niven, R; Khalili-Naghadeh, N; Pashley, RM	PFAS Source Zone Remediation by Foam Fractionation and In Situ Fluidisation	Australian Research Council Special Research Initiatives/ Industry Partner Contribution - Opec Systems Pty Ltd	350000
Oldfield, PF;; Carmichael, DG	Carbon Value Engineering	CRC For Low Carbon Living Limited / Research Grants	24137
Russell, A	Evaluating potential static liquefaction of tailings to prevent failures	ARC Linkage Project Industry Partners - Anglo American Services (UK) Limited / Freeport-McMoRan Inc / Teck Resources Limited	84827
Russell, A	Understanding Earthquake-induced Ground Deformation Risk to Inform City Resilience	ARUP Pty Ltd / Contract Research	18182
Shen, X; Carmichael, DG	Evaluating Light Detection and Ranging (LiDAR) Sensors for Construction Mapping	Linke & Linke Surveys / Contract Research	50000
Song, C	Deterioration of structural integrity of ageing ships and marine platforms	University of Newcastle / ARC Linkage Project Shared Grant: Shared Partner Organisation Contribution DSTG, & Pacific ESI	28370
Song, C	Seismic analysis of cracking and deformations in concrete gravity dams	Australian Research Council / Linkage Project Industry Partners Melbourne Water Corporation / Goulburn-Murray Water / Murray-Darling Basin Authority / Sunwater Limited /	173422
Song, C; Tin Loi, FS	3D contact and fracture analysis for safety assessment of structures	Australian Research Council / Discovery Project	128000
Song, C ; Zhang, J	3D numerical modelling of an underground complex	PSM Admin Pyt Limited / Contract Research	8261
Li, B ; Saydam, S ; Guivant, J ; Shen, X; Rizos, C ; Sammut, C; Katupitiya, J; Zlatanova, S	Development of the mobile robot for underground mine 3D mapping and environment monitoring	Jiangsu Tianqin Patent & Technology Co / International Contract	250000
Total CIES			**$2,067,335**

Our People

Academic Staff

Attard, Mario
Associate Professor
Associate Head – Academic
BE PhD MHEd UNSW, MIEAust, CPEng

Research Interests: Finite Strain Isotropic & Anisotropic Hyperelastic Modelling; Anisotropic Hyperelastic Modelling of Biological Material; Plasticity Formulation for Confined Concrete Columns; Cover Spalling in High Strength Reinforced Concrete Columns; Lateral Buckling of Thin-Walled Beams.

Atroshchenko, Elena
Senior Lecturer
MSc in Mechanics and Applied Mathematics, Saint-Petersburg State University
PhD in Civil Engineering, University of Waterloo, Ontario

Elena's research interests lie in the area of Computational Mechanics and Numerical Methods, with application to fracture mechanics, acoustics, bending and vibration of composite plates.

Bidarmaghz, Asal
Lecturer
PhD Civil Engineering (Geothermal Technologies) University of Melbourne

Research Interests: Energy geo-structures and geothermal systems, Investigating the impacts of urbanization on subsurface temperature increase at the city-scale, Uncertainty analysis of large scale subsurface hydro-thermal models.

Bradford, Mark
UNSW Scientia Professor
BSc BE PhD USyd, DSc UNSW, CPEng, CEng, MASCE, FIEAust, MIStructE

Research Interests: High-strength steel structures, steel-concrete composite structures, steel-timber hybrid structures, concrete structures, arches, geometric non-linearity, pavement thermo-upheaval buckling, railway thermo-lateral buckling, design for deconstructability, low-emissions structural paradigms, forensic engineering..

Carmichael, D G
Professor
BE MEngSc USyd, PhD Cant, CPEng, FIEAust, MASC

Research Interests: Management, systems applications of optimisation, synthesis: Identification & analysis: Contracts & disputes: Project delivery: Construction operations: Project management & management functional areas including risk, economics, finances, people resources & scope: Construction management: Problem solving & decision making.

Castel, Arnaud
Associate Professor
BE, MEngSc, PhD Toulouse

Research Interests: Durability of construction materials, low carbon concrete technology, alternative SCMs, Geopolymer concrete, Performance based & service life design, Steel reinforcement corrosion in concrete, serviceability, time-dependent effects, restrained shrinkage induced early age cracking.

Dackermann, Ulrike
Lecturer
Dipl.-Ing. Univ., Technical University of Munich (TUM), PhD UTS

Research interests: Structural Health Monitoring, Non-Destructive Testing, Damage Detection, Structural Dynamics, Artificial Intelligence, Timber Engineering

Davis, Steven
Senior Lecturer
Chair, Teaching & Learning Committee
BE PhD UNSW

Research Interests: Online Assessment, Virtual Reality, Project Scheduling, Safety, Construction Defects and Rework.

Douglas, Kurt
Pells Sullivan Meynink Senior Lecturer of Rock Mechanics,
Chair External Relations
BE (Hons1)USyd, PhD UNSW

My interests lie in the field of rock mechanics and dam engineering. Predicting field properties of rock masses continues to be a major challenge for us to address. My dams research focusses on spillway erosion and backward erosion of dams.

Eisentrager, Sascha
Lecturer
Doctor of Engineering (Computational Mechanics), Otto von Guericke University Magdeburg, Germany

Sascha's research is within the context of structural health monitoring (SHM) applications, particularly with the development of efficient numerical methods for the analysis of wave propagation phenomena in thin-walled structures. Therefore, the propagation of elastic guided waves (Lamb waves, Love waves, Rayleigh waves, etc.) is an important area for his innovative high order finite element and fictitious domain approaches.

Foster, Stephen
Professor and Acting Head, School of Minerals & Energy Resources Engineering (MERE)
BE NSWIT, MEngSc PhD UNSW, MIEAust, FIEAust

I research the behaviour of structural systems (buildings and bridges) constructed of reinforced and prestressed concrete. I'm particularly interested in bringing new and advanced materials technologies to the engineering of structures. My interests are in the use of high and ultra-high performance concretes, fibre-reinforced concretes and geopolymer concretes and in use of carbon fibre technologies for strengthening and repair of structures and structural systems. I develop physical-mechanical models for use in advanced computational and numerical tools such as FEM and for their use in the study of behaviour of concrete structures that are subjected to extreme events.

Gao, Wei
Professor
BE HDU, ME PhD Xidian, MIIAV, MAAS

Research Interests: Uncertain modelling & uncertain methods: Vehicle-bridge interaction dynamics: Wind and/or seismic induced random vibration: Train-rail-sleeper-foundation-tunnel/bridge system: Stochastic nonlinear system: Vehicle dynamics & vehicle rollover: Structural optimization & control: Smart structures: Stability & reliability analysis.

Hajimohammadi, Ailar
Senior Lecturer
Ph.D. (sustainable cementitious materials) University of Melbourne

Ailar's research examines the chemistry of materials to develop innovative construction elements with attractive properties. She is also investigating waste management and resource recovering strategies towards the circular economy in civil and construction projects

Hamed, Ehab
Associate Professor
BSc MSc PhD Technion

Research Interests: Viscoelastic behaviour of materials and structures, strengthening of structures with FRP composite materials, sandwich panels.

Holdom, Robert
Senior Lecturer

Research Interests: construction management.

WELCOME

Kashani, Alireza
Lecturer
BSc, MSc Amirkabir University of Technology, Tehran
PhD University of Melbourne

Lecturer and Churchill Fellow in Sustainable Construction Automation and 3D Printing with extensive experience in research, development, and commercialisation of advanced and sustainable construction materials. Research areas include development of novel high-performance materials and techniques for construction 3D printing, and sustainable construction materials for the 'Circular Economy' including wastes valorisation, low-carbon construction materials and sustainable concrete.

Khalili, Nasser
Professor and Acting Head of School CVEN
BSc Teh, MSc Birm, PhD UNSW

Research Interests: Mechanics of unsaturated soils: Flow & deformation in double porosity media: Numerical methods applied to geotechnical engineering: Pavement engineering.

Khoshghalb, Arman
Senior Lecturer
BEng, MEng, Sharif University of Technology, Tehran, PhD UNSW

Research Interests: Mechanics of unsaturated soils, coupled analysis of porous media, advanced numerical methods in geomechanics, modelling discontinuities in porous media, large deformation analysis in geomechanics, stabilisation techniques in computational geomechanics, constitutive modelling of geomaterials, dynamic properties of geomaterials.

Kim, Taehwan
Lecturer
BSc, MSc KAIST, PhD Purdue USA

Research Interests: Advanced and sustainable infrastructure materials: Thermodynamics in cementitious materials and the modelling of their chemical process: Advanced materials characterization techniques: fundamental understanding of chemo-physical reactions in cementitious materials: Microstructure evolution of cementitious materials: Utilizing natural and waste materials to develop low carbon foot-print materials.

Makki Alamdari, Mehrisadat
Lecturer
BSc Sharif, MSc Iran University of Science and Technology, Mech Eng
Manitoba, PhD UTS

Research Interests: Structural Health Monitoring, vibration analysis and testing, structural dynamics, inverse dynamic problems, signal processing and data mining. Mehri is on the Executive of the Australian Network of Structural Health Monitoring (ANSHM), and a member of The International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII). Research Interests: Structural Health Monitoring, vibration analysis and testing, structural dynamics, inverse dynamic problems, signal processing and data mining. Mehri is on the Executive of the Australian Network of Structural Health Monitoring (ANSHM), and a member of The International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII).

Russell, Adrian
Associate Professor
BE, PhD UNSW, PGCert Bristol

Research Interests: Applied unsaturated soil mechanics; Liquefaction of variably saturated soils and tailings; Fundamental modelling of soils linking microstructure to large scale behaviour; Fundamental rock mechanics: Fibre reinforced soils.

Shen, Johnson Xuesong
Senior Lecturer
BEng, MSc Nanjing, PhD Hong Kong Polytechnic University

Research interests: Digital Twins, Artificial Intelligence, Smart Sensing, Autonomous Systems, Internet of Things, Mixed Reality, and their applications in the construction, operation, and maintenance of civil infrastructure and built environment.

Song, Chongmin
Professor and Director CIES
Chair, Computing, IT & Ed Tech Ctte BE ME
Tsinghua, DEng Tokyo

Research Interests: Scaled Boundary Finite-Element Method, Mesh Generation, Dynamic Soil-Structure Interaction, Structural Dynamics & Earthquake Engineering, Fracture Mechanics, Elasto-Plastic-Damage Constitutive Modelling.

Vali Pour Goudarzi, Hamid Reza
Associate Professor
BE, MEngSc, PhD UNSW

Research Interests: Structural mechanics; Development of innovative hybrid steel-timber-concrete structures with emphasis on sustainability and improved structural performance; Behaviour of structures subjected to extreme loads such as earthquake, impact, blast and explosion: Computational mechanics and non-linear finite element modelling of structures: Constitutive modelling of materials.

Zhao, Xiao Lin (Joshua)
Professor and Associate Dean (International), Faculty of Engineering
BE, ME Shanghai Jiao Tong University, PhD and Doctor of Engineering,University of Sydney
MBA (Executive) UNSW/USyd

Professor Xiao Lin (Joshua) Zhao's current research focuses on hybrid construction utilising seawater, sea sand concrete and fibre reinforced polymers; rehabilitation of aging infrastructure using advanced composite materials; and ultra-high strength steel structures.

Emeritus Professors

Fell, Robin

Gilbert, Ian

Tin Loi, Francis

Valliappan, Somasundaram

Farewell

During 2019 the Centre sadly farewelled Associate Professor Arnaud Castel - we congratulate him on his wonderful new position and wish him all the very best as Professor at the School of Civil & Environmental Engineering, University of Technology, Sydney.

Centre Research Staff

CIES Staff

Chen, Jun	Postdoctoral Fellow
Chhor, Allen	Senior Research Associate
Chilwesa, Masuzyo	Research Associate
Hassanieh, Amirhossein	Research Associate
Liu, Lei	Postdoctoral Fellow
Masoumi, Saeed	Research Associate
Parvez, Md Ahsan	Postdoctoral Fellow
Saputra, Albert	Postdoctoral Fellow
Shahbodaghkhan, Babak	Senior Research Associate
Vahab, Mohammad	Research Associate
Vo, Thanh Liem	Research Associate
Wu, Di	Research Associate
Xing, Weiwei	Research Associate
Yu, Yuguo	Research Associate
Zhang, Junqi	Research Associate

Visiting/Adjunct Academics

Akbarzadeh Chiniforush, Alireza	Visiting Fellow
Aldred, James	Adjunct Associate Professor
Delhomme, Fabienne	Visiting Fellow
Eisentrager, Johanna	Visiting Fellow
Geha, Shane	Adjunct Professor
Gong, Weijia	Visiting Senior Lecturer
Gravenkamp, Hauke	Visiting Fellow
He, Yiqian	Visiting Fellow
Kayvani, Kourosh	Adjunct Professor
Koenke, Carsten	Visiting Professor
Krahulec, Slavomir	Visiting Senior Lecturer
Li, Haifeng	Visiting Fellow
Li, Jianbo	Visiting Fellow
Liang, Heng	Visiting Senior Lecturer
Rosso, Kevin Michael	Adjunct Professor
Salmanpour, Amir Hosein	Visiting Fellow
Shi, Junjie	Visiting Fellow
Voo, Yen Lei	Adjunct Associate Professor
Wei, Minghai	Visiting Fellow
Yu, Bo	Visiting Fellow
Zhang, Zihua	Visiting Fellow

Our Professional & Technical Staff

Technical Services (Kensington)

Paul Gwynne
Lab Manager

Anthony MacKen
Senior Technical Officer

William Terry
Senior Technical Officer

Luiz Pettersen
Technical Officer

Rudino Salleh
Technical Officer

Timothy Weston
Technical Officer

Technical & Professional
(Heavy Structure Laboratory Randwick)

Zhen-Tian Chang
Laboratory Manager

Sanjeewa Herath
Senior Technical Officer

Tuan Le
Postdoctral Technical Assistant

Ronald Moncay
Senior Technical Officer

Benjamin Pauley
Technical Officer

Greg Worthing
Technical Officer

Research Centre Management

Theresa Wisniewski
CIES Manager

Welcome

Dr Elena Astroshchenko

Dr Elena Astroshchenko joined the academic staff at CVEN in 2019 as a Senior Lecturer specialising in computational mechanics and numerical methods.

Raised in Russia, Dr Astroshchenko completed her undergraduate and Masters Science degree there, focusing on developing mathematical models for ophthalmology. Then, off to Canada for 6 years and a PhD. It was there, at the University of Waterloo, that Elena's focus shifted to civil engineering, working as a teaching and research assistant while she completed her own research in computational modelling for fracture mechanics. This research earned her the position of Assistant Professor at the University of Santiago, Chile.

One current project with her colleagues from Santiago is about harvesting energy from piezo-electric plates, but Elena's main focus will be in acoustics: design optimisation for acoustic devices and structures and health monitoring of structures using sound waves. This work in acoustics takes Elena to the University of Luxembourg each year, where she is an associated member of the international Legato team in computational mechanics. Led by Professor Stephane Bordas, Legato "aims at building intuitive and interactive platforms for computational mechanics problems which allow the users to interact with their models and hence gain insights into unconventional and counter-intuitive phenomena."

Finite Element Method is the central thesis of computational mechanics. It is employed widely, through software, at commercial levels. Elena Astroshchenko propels her field forward by merging this established numerical method with computer-aided design. Isogeometric Analysis (IGA) is a recent innovation that improves modelling of new designs during development, making modelling easier and quicker. Only developed in the last decade Elena is an expert in an elite but growing field. "It is yet to be licenced commercially, but the many advantages of IGA are making it a popular area for research."

While Elena and her family loved Chile, she hopes to stay still for a little while, here in Sydney, here at CVEN. "I am very impressed with this School and UNSW. It seems big, not only in terms of size, but in its development and possibilities. But the people are very, very friendly, very supportive. I feel like I am home. I love the multi-cultural society here."

Dr Asal Bidarmaghz

Arriving in Sydney from her position as a Research Associate with the Centre for Smart Infrastructure and Construction at Cambridge University, Dr Asal Bidarmaghz has found her CVEN welcome enthusiastic, warm and practically helpful: "like they were waiting for me". As a Lecturer in Geotechnical Engineering, Asal brings to us her extensive knowledge and experience in the nascent field of subterranean geo-energy systems, having received her PhD in Civil Engineering (Geothermal Technologies) from the University of Melbourne in 2015.

"There is a problem, a big problem," she says. World leaders are not fully acknowledging nor acting upon the true impacts of climate change. Moreover, underground climate change is very rarely considered or discussed. Nor is geo-energy utilised as a resource, even though it is ever present, available and the technology to access it has been developed. But Asal Bidarmaghz is a gently hopeful engineer, who believes in the power of hard work and persistence, bolstered by collegiate support and right-minded institutions.

"The challenge with industry is to create business cases for geo-energy system projects. I feel confident, this is do-able. We cannot go backwards."

Asal's research, begun during her PhD in Melbourne and continued at Cambridge, reveals the particular climate change challenges created by ever increas-

ing urbanisation. Cities create 'urban heat islands', where temperatures far exceed those of the surrounding rural areas. This promotes the need for electric cooling, the need for resources.

We need to be asking what effect do our underground structures, such as basements, car parks and activities like transport tunnelling, have on the surrounding environment? Could the heat generated by such activities be extracted and exploited as 'smart heat'? "In city-scale, there are gigawatts of ground energy freely available to us, but there is a lack of understanding as we continue to burn coal. We need the different sectors working together in urban planning."

The benefits of geospatial research to city planners, asset owners, local authorities and citizens are many and seemingly obvious: alternative, sustainable and free energy sources, optimal use of subterranean spaces in city planning and positive impacts on general wellbeing of urban inhabitants. Frustratingly, Australian industries and governments are not yet fully convinced; perhaps revealing "a resistance to anything new and expensive", so this continued research is vital to enacting change in our cities.

Dr Sascha Eisentrager

Dr Sascha Eisentrager arrived in Sydney In June 2019 from Otto von Guericke University in Magdeburg, Germany. He is, however, no stranger to Australia, having completed some of his postgraduate studies in Adelaide. As a CVEN Lecturer and a member of the Centre for Infrastructure and Engineering Safety (CIES), Sascha will be developing his research in Computational Mechanics, especially in high order Finite Elements Methods (FEM).

Dr Eisentrager's enthusiasm for computational mechanics began early in his career and he has continued to refine his approach. "Computational mechanics (CM) is a broad range of different methods, commonly based in numerical approaches, and used to solve partial differential equations. All physical problems present a certain set of partial differential equations (PDEs) to which we have to apply numerical (approximative) methods. I concentrate on Finite Element Methods in the context of high order shape functions. Commercially, FEMs often utilize linear or quadratic shape functions, but I try to exploit the inherent advantages of high order ones."

Simultaneously, Eisentrager is developing proposals for the German Research Foundation and the Australian Research Council. These projects will investigate modelling the behaviours of complex acoustic materials like dampening foams. These materials exhibit both open and closed cell structures that make modelling a complex challenge, necessitating high performance computing technology. "We will look at the relationship of these complex materials to the environments in which they are used. In urban areas, uses such as engine encapsulation can reduce noise pollution. Engine heat can be retained to increase start up efficiency, reducing emissions and fuel consumption. These materials could have positive effects on urban well-being."

Eisentrager would also like to build more understanding between the engineering academy and the engineering industry. "Certain commercial computational methods are based in knowledge from the 1980s and 1990s, while the newer computational research has the potential to greatly increase industrial efficiency. Sometimes industry can be a little conservative, reluctant to invest either time or money to adopt new methods." He sees the distinction between academic researchers and industry as being neatly articulated by the Pareto Principle. "80% of the work is completed in 20% of the time. To get to that final 20% of the work, a big time and resource investment is needed, but it is here that innovation, academic rigor and excitement lie."

Dr Ailar Hajimohammadi

Dr Ailar Hajimohammadi joined the academic staff of CIES and the School of Civil and Environmental Engineering as a Senior Lecturer. Originally interested in chemical engineering, Dr Hajimohammadi's PhD research on sustainable cementitious materials shaped her current focus on innovative construction materials and techniques.

This shift to civil and environmental engineering has allowed her research to become more multi-disciplinary and collaborative. "The most innovative way I can approach my research is to look at the problem from different angles," she reflects. "Rather than just focusing on what I already know, I want to know how others see the problem, how other disciplines are approaching it. In this way new methods, new solutions appear. Useful, important, but also very interesting for me. Multi-disciplinary university structures allow for increased communication, visibility and opportunities for academics to work in less isolated ways."

For the last 4 years Ailar has been working with a waste recovery group she led under an ARC Linkage program to uptake landfilling wastes and convert them to valuable products.

She also works with industry and the academy on the many innovative applications of sustainable construction materials. These materials can utilise recycled waste products, can create cheaper, more durable materials as alternatives to traditional concrete. Also, they can be designed to provide insulation, retard fire and dampen noise. In fact, sustainable materials and technologies research has the potential to revolutionise the civil engineering and construction industries. Not only does it represent green innovation in its use of waste materials, but it can transform the affordability of our built environment.

"We may have started with concretes, but sustainable alternatives have evolved into more complicated composites, with more load bearing construction potential. There is tremendous growth in its applications for fire-resistant high-rise buildings and for sound dampening road barriers", both so important in a city like Sydney where high-rise buildings sprout like seedlings and the noise of traffic and construction threatens liveability. "The use of sustainable materials in construction can also extended to other civil applications such as water treatment technologies and soil stabilisation methods, so it is beneficial and interesting to find mutual interest between disciplines.

"Generally, I hope that my research will lead to an increase in the resilience of construction materials while decreasing their negative environmental impact."

Dr Ali Kashani

In 2019 we welcomed Dr Ali Kashani – a 2018 Churchill Fellow, and expert in the field of sustainable concrete design and technology - specifically waste valorisation and circular economy in concrete design, lightweight concrete, geopolymer concrete, and automated construction 3D printing.

Dr Kashani has extensive experience in research, development, and commercialisation of advanced and sustainable construction materials. His primary research area is 'Construction Automation' via development of novel high-performance materials and techniques for construction 3D printing. His other main area of research is sustainable construction materials for the 'Circular Economy' including waste valorisation and low-carbon construction materials.

Ali received his BSc and MSc from Iran's leading technical and engineering university, Amirkabir University of Technology in Tehran. He obtained his PhD in 2015 from The University in Melbourne with research into the rheology and fresh properties of low-carbon geopolymer concrete. As a postdoctoral researcher at The University of Melbourne, his focus widened into development of sustainable lightweight concrete, design of concrete with waste tyre and waste glass, and exploration of the innovative field of construction 3D printing.

He has been the Project Leader in several R&D projects funded (to a total of $645,000) by government entities and construction industry leaders in Australia, to promote research in advanced and sustainable concrete. He continues to look at partnerships with industry. "We are looking forward to working with cement and concrete industries and building standard regulators to prove the viability of using sustainable concrete with recycled materials in different applications"

Automation in construction by 3D printing is another main research interest. And this area is proving equally exciting and fruitful. One of Dr Kashani's recently papers as a corresponding author about 3D printing was published in the high-impact Elsevier Journal 'Composites: Part B' in June 2018. It has attracted 331 citations so far.

It was this area of research which won Ali a prestigious Churchill Fellowship in 2018. The 3D project has the potential, he notes, to assist with more sustainable, faster and safer construction of affordable houses and to provide housing solutions to disadvantaged Australian communities and homeless people. These technologies could also be used to provide rapid accommodation for affected communities after natural disasters such as floods and bushfires.

Professor Xiao-Lin (Joshua) Zhao

In 2019 we were delighted to welcome Professor Xiao-Lin (Joshua) Zhao to the School.

Professor Xiao-Lin (Joshua) Zhao has very recently taken up an appointment as the new Associate Dean (International) for UNSW Engineering.

Professor Zhao's very impressive academic background began at Shanghai Jiao Tong University where he commenced study at just 16 years of age. Graduating in 1984, with a Bachelor of Mechanical Engineering, he went on to study his Masters degree in the same field. He graduated in 1987 and came to Australia in 1988 to study at the University of Sydney, this time in the field of Civil Engineering, receiving his PhD in 1993. He completed an MBA from the AGSM in 2007, making him an alumnus of UNSW. He also received a Doctor of Engineering (higher doctorate) from the University of Sydney in 2012.

In 2001 Professor Zhao was appointed Chair of Structural Engineering at Monash University.

Zhao has received several prestigious fellowships, such as the von Humboldt Fellowship of Germany, JSPS (Japan Society for Promotion of Science) Invitation Fellowship of Japan, Distinguished Visiting Fellowship Award from the Royal Academy of Engineering, UK, Visiting Professorship Award from Swiss National Science Foundation, National "1000-Talent" Chair Professorship and Chang Jiang Professorship of China.

He has received 25 grants from the Australian Research Council and served on the ERA (Excellence in Research for Australia) Research Evaluation Committee for Engineering and Environmental Sciences Cluster in 2015 and 2018. He has also supervised 40 PhD students to completion.

More recently, Professor Zhao was Head of the Department of Civil Engineering at Monash University for four years after being Deputy Head and Director of Research in the Department for seven years. Professor Zhao has extensive experience working in international environments leading the Department in several major international initiatives such as the Monash-Sichuan University alliance, Monash-IIT-B academy, Monash-Warwick alliance and Monash-Southeast University Alliance.

We look forward to many opportunities for Professor Zhao to share his extensive knowledge and experience with us.

PhD Graduates

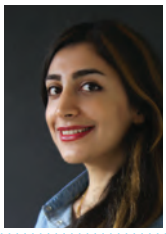
PhD

Alireza **Akbarzadeh-Chiniforush**
Serviceability of Steel-Timber Composite (STC) floors
Supervisor/s: A Akbarnezhad & H Valipour

Golnaz **Alipour Esgandani**
Elasto-viscoplastic modelling of unsaturated soils under static and dynamic loading in 3D stress space
Supervisor/s: N Khalili & A Khoshghalb

Dion Dilina **Dissanayake**
Automatic image-based adaptive damage analysis (AIBADA) with the scaled boundary finite element method
Supervisor/s: C Song

Jinwen **Feng**
Unified probabilistic and interval analysis of structures with hybrid uncertainties
Supervisor/s: W Gao & G Li



Maryam Ghareh **Chaei**
Investigating early age thermal cracking of concrete
Supervisor/s: A Akbar Nezhad& A Castel

Dinesh **Habaragamu Arachchige**
Durability of Geo-Polymer Concrete with respect to Alkali Aggregate Reaction (AAR)
Supervisor/s: A Castel

Ying **Hong**
BIM adoption criteria: measuring potential advantages of BIM before implementation
Supervisor/s: A Akbarnezhad

Qian **Huang**
Time-dependent behaviour of precast concrete sandwich panels
Supervisor/s: E Hamed

Nicka **Keipour**
Assessment of beam-to-column joint behaviour in steel-timber composite systems
Supervisor/s: H Valipour

Hammad Anis **Khan**
Durability of alkali-activated mortar in sewage environment
Supervisor/s: A Castel

Haiwen **Li**
Dynamic properties of sand-fiber mixtures
Supervisor/s: A Khoshghalb

Keyan **Li**
Spectral Stochastic Isogeometric Analysis
Supervisor/s:W Gao

Hugh David **Miller**
Surface treatment of steel fibres and carbon nanotubes to develop chemical bonds with concrete
Supervisor/s: A Akbarnezhad & SJ Foster

Hamed **Moghaddasi Kelishomi**
Constitutive modelling of bonded geomaterials subject to the mechanical and moisture degradation
Supervisor/s: N Khalili & A Khoshghalb

ME

Masoud **Moradi**
Reserve of strength in prefabricated reinforced concrete slab of bridge decks and RC culverts
Supervisor/s: H Valipour

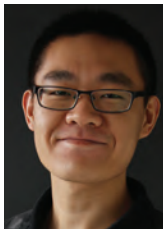
Farshid **Nouri**
Experimental and numerical study of steel-timber composite beam-to-column connections with shear-tabs/double web-angles
Supervisor/s: H Valipour

Daniel **O'Shea**
Hyperelasticity for soft biological tissues and fibre-reinforced composites using orthotropic fourth-order tensors
Supervisor/s: M Attard

Arash **Tootoonchi**
Numerical aspects of the application of smoothed point interpolation methods in computational geomechanics
Supervisor/s: A Khoshghalb

Rumman **Waqas**
The behaviour of composite beam-to-column flush end plate connections using blind bolts
Supervisor/s: B Uy

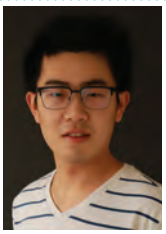
Weiwei **Xing**
A scaled boundary finite element based node-to-node scheme for contact problems.
Supervisor/s: C Song & FS Tin-loi



Junqi **Zhang**
Integrating geometric modeling and structure analysis: towards the digital future of engineering
Supervisor/s: C Song

Sijia **Jiang**
Evaluation of Lateral Earth Pressure for Unsaturated Soils
Supervisor/s: A Khoshghalb

Zhanpeng **Liu**
Stability analysis of advanced composite arches
Supervisor/s: W Gao & G Li

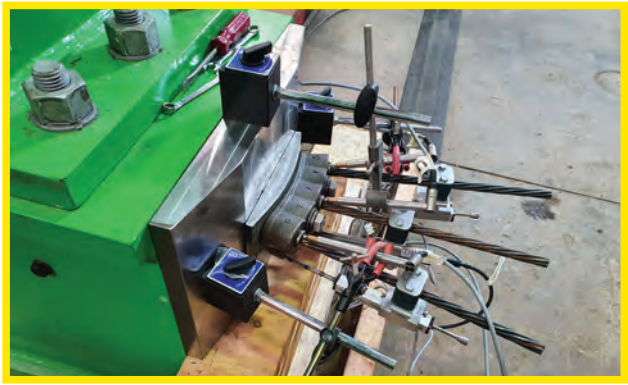


Qihan **Wang**
Machine learning aided stochastic analysis for functionally graded structures
Supervisor/s: W Gao & FS Tin-Loi

Our Research

Our Laboratories

CIES research and commercial activities are conducted with extensive physical laboratory resources, such as those of the Heavy Structures Research Laboratory, Advanced Materials Research Laboratory, Geotechnical Laboratory and the Advanced Computational Analysis Laboratory (ACAL). Through these state-of-the-art facilities we are able to conduct our blue sky and applied research, for industry and government partners.



Some Research Highlights

New geotechnical research to significantly reduce infrastructure costs

Billions of dollars are spent each year across Australia building infrastructure. High rates of infrastructure spending are expected to continue to meet the needs of Australia's growing population, which is expected to double by the year 2060 (ABS, 2008).

Safety of structures and humans is of crucial importance to engineers and engineering design. Where behaviour and properties of materials are not well understood, engineers will, of necessity, adopt a conservative approach to design to maintain this safety, sometimes at considerable financial cost to the public.

CIES researchers with industry support have recently completed a very successful ARC Linkage Project (LP140101078): Experimental investigation and constitutive modelling of weak rocks subject to mechanical and moisture degradation.

Weak rocks are geomaterials that fall in the boundary between soils and rocks in terms of mechanical properties. Such geomaterials constitute a major portion of the shallow rocks in Australia. Despite their prevalence, the characteristics of weak rocks have been poorly understood mainly due to problematic sampling, lack of proper investigation measures - such as experimental equipment and methods, and the complex mechanical behaviour such materials show.

Indeed, the lack of understanding and predictive tools for the behaviour of weak rocks have over the years led engineers to adopt a conservative and often expensive approach to design.

The Project and Objective:

The aim of this ARC Linkage research project was to advance experimental, theoretical and computational bases for the mechanics of weak rocks, so as to provide scientists and engineers with much-needed predictive tools for quantitative evaluation and assessment of their behaviour in geological settings.

The project used an extensive experimental program, combining rigorous fundamental studies with robust and efficient numerical schemes. By incorporating previously neglected aspects in the behaviour of weak rocks such as mechanical, environmental as well as cyclic loading degradation, it aimed to increase practitioner confidence in the design methods, to the point where costly over designs can be avoided.

The project was led by CIES Professor Nasser Khalili with other investigators, Dr Arman Khoshghalb and John Rubsov, Director Technical Operations & Support at Roads and Maritime Services. Two CIES PhD students, Hamed Moghaddasi Kelishomi and Mohammad Khoshini, also closely collaborated with the industry partners of the project, TfNSW (formerly RMS), and Pells, Sullivan & Meynink (PSM) Consulting.

The research team conducted research on the development of procedures for cost-effective design of cut batters, soil nailing, retaining structures and bridge foundations in low strength rocks encountered in the Upper Blue Mountain region of NSW.

An extensive experimental program was devised and successfully conducted to completely characterise the material.

Rigorous fundamental studies were performed to understand the mechanisms behind the behaviour of the material and a complete set of constitutive laws for weak rocks describing the degradation effects of cyclic loading, moisture, and damage due to de-bonding of grains and the strongly non-linear deformation behaviour of the rock matrix were developed.

Robust and efficient numerical schemes for the solution of the constitutive equations suitable for implementation into the numerical code FLAC were also developed.

Key Findings

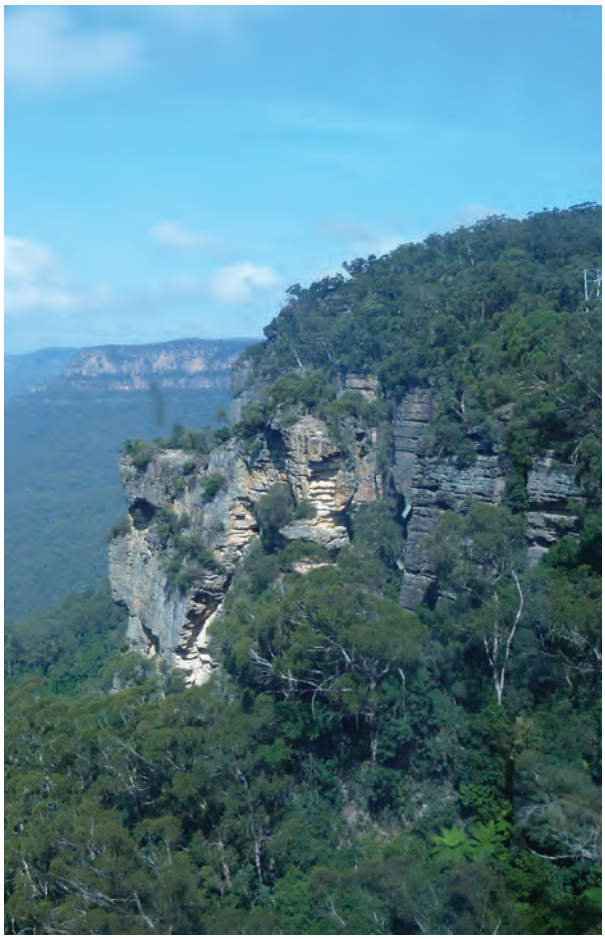
Models, theories and relationships derived from this research will have direct and immediate impact on design, construction and management of geotechnical engineering projects including roads, tunnels, bridges, under- and over-ground excavations.

One of the immediate beneficiaries of the findings of this research is the current upgrade project of Great Western Highway in Upper Blue Mountains of NSW from Leura to Katoomba. The notorious weak rock encountered in the upper Blue Mountain region is no longer an unpredictable difficult material to deal with for geotechnical engineers.

Image Credits:

https://www.rms.nsw.gov.au/projects/02images/great-western-highway/katoomba-to-lithgow/katoomba-to-lithgo-hero-1155x360.jpg

https://www.bluemts.com.au/getting-here/



The future is digital

One hundred and twelve inspired Australians travelled throughout the world during 2019 as recipients of the prestigious Churchill Fellowship, offering them the opportunity to investigate inspiring practices in other countries that will benefit Australian communities.

Amongst the investigative travellers was CIES lecturer and researcher, Dr Ali Kashani, an expert in sustainable construction design and materials.

Dr Kashani was awarded the AV Jennings / Churchill Fellowship to explore the new technology for rapid construction of resilient and low-cost houses by 3D printing – and visited several institutions and organisations involved in the field in six countries - Denmark, Netherland, France, Switzerland, Italy and Singapore.

Dr Kashani's aim for his travels was to gather insights and knowledge about the revolutionary construction method: '3D Printing of Houses'. The practical knowledge for 3D printing of houses is currently limited in Australia. Dr Kashani investigated current challenges and trends with regards to both manufacturing and building standards.

Kashani believes that the 3D project has the potential to aid with more sustainable, faster and safer construction of affordable houses and to provide housing solutions to disadvantaged Australian communities and homeless people.

source

Image Credit: http://contourcrafting.com/building-construction/

"These technologies" he says, "could also be used to provide quick accommodation for affected communities after natural disasters such as floods and bushfires. There is also potential for increased creativity and customisation, with young people able to build their own DIY first home with considerably lower construction costs and minimum skills required."

"3D printing technologies can also enable architects to push the boundaries of construction design, upgrade the skills of construction workers and enable the construction industry to offer vastly different customised house designs at cheaper costs that are based on the needs of each individual customer."

His report back shows that digital construction is feasible, and that it will become part of the future of the construction.

Key findings and recommendations of his Churchill Fellowship are summarized below:

- The range of successful prototypes and projects using digital construction is relatively vast, including houses, apartments, a façade, pedestrian bridges, telecommunication pillars, furniture, landscaping and architectural features.
- Digital construction and 3D printing is in its infancy period and requires further R&D to become a routine construction method, but it can offer all the benefits mentioned above when it matures.
- The main challenges include the adoption of the construction materials and processes for digital construction, lack of legislation and building codes, risks of failure in large-scale construction projects and resistance in the adoption of new technologies by the construction industry.
- With all the challenges and risks, a growing number of small and large businesses and institutions are investing in digital construction to benefit from the sustainable competitive advantages of this new technology.
- The Australian construction industry is lagging behind in adoption of digital construction compared to the developed countries, but this situation can be changed through R&D, collaborative projects, and partnership between research institutes and industries.

Dr Kashani's full report can be downloaded from the Churchill Trust website:

https://www.churchilltrust.com.au/fellows/detail/4337/Alireza+Kashani

How to save the world, one road at a time

CIES researchers are at the helm of an emission-reducing, green roads project. Concrete made using industrial waste from coal-fired power stations and steel manufacturing is being used in a world-first green roads trial in Sydney.

The CRC for Low Carbon Living-funded project with The City of Sydney is putting the environmentally friendly building product to the test on a busy inner-city street, replacing a 30 metre section of roadway on Wyndham Street in Alexandria. As a major road leading to Sydney Airport, the high traffic volume provides the perfect conditions for the trial.

CIES Professor Stephen Foster, Head of School of Civil and Environmental Engineering, is the CRCLCL project lead and describes the trial as “a huge step forward”.

“This trial will help drive step change in the industry. Many concrete companies are already doing a lot to change, but this trial really gives it another push,” Professor Foster said. “Research into Geopolymer has been undertaken since the 90s, but it’s only now that it’s starting to be commercialised.”

Several members of CIES have been involved in geopolymer research including Professor Foster, Associate Professor Arnaud Castel, Dr James Aldred, Dr Taehwan Kim and Dr Johnson Shen, and the Centre is now recognised as a world expert on sustainable construction materials.

As Professor Foster noted, “This trial is important because we need demonstration projects to accurately assess the performance of Geopolymer over time so that there can be broader uptake. While we’ll monitor the road performance for up to five years,

a lot of the data collected in the first three to 12 months of this world-first trial will be used to confirm our models and strengthen our predictions."

Made from fly ash and blast furnace slag, Geopolymer generates just 300 kilograms of CO^2 per tonne of cement, compared to the 900 kilograms from traditional cement production.

Concrete contributes seven per cent of all greenhouse gas emissions and in 2018 the world produced about 4.1 billion tonnes of cement, which contributed about 3.5 billion tonnes of CO^2 . Alternative, low CO^2 concrete materials offer potential benefits in reducing the greenhouse gas emissions associated with conventional concrete.

Moreover, the low CO^2 concrete has the potential to put the 400 million cubic tonnes of globally documented waste from the coal and steel industries to good use. While a small amount is currently reused in construction, much of it is currently stored on site.

Industry partner: Australian (Iron and Steel) Association and Ash Development Association

Industry partner Craig Heidrich, executive director, Australian (Iron and Steel) Association and Ash Development Association, says the benefits of the trial will be far-reaching.

"Our collaboration with organisations such as the City of Sydney and the publication of the research findings will further de-mystify and promote the use of Geopolymer concrete in construction. Geopolymer concrete has great engineering properties. It is a durable, high performance product that has a low carbon footprint when used in construction," Mr Heidrich said.

"It's a fundamental tenet in business that you need to be constantly innovating and investing into new technologies. This trial will provide real examples of Geopolymer concrete use that we can all use."

Support from City of Sydney- Australia's first carbon-neutral local government

To test the green concretes durability, the City of Sydney has laid a 15 metres traditional concrete and 15 metres of Geopolymer concrete, a sustainable blend of concrete and recycled materials. Nine sensors have been positioned under the concrete to monitor and compare how the Geopolymer concrete performs.

UNSW Sydney researchers and the CRC for Low Carbon Living (CRCLCL) will then use results from the trial to create the first set of industry guidelines for Geopolymer concrete.

Lord Mayor Clover Moore said the City was committed to finding new ways to lower carbon emissions. "I'm proud that the City of Sydney was Australia's first carbon-neutral local government and that we're continuing to take significant steps to reduce our carbon footprint," the Lord Mayor said."Local governments are responsible for maintaining local roads, so if we can purchase more environmentally sustainable materials, we can fight climate change and provide quality infrastructure for our community.

"With 70 percent of the concrete produced today going into pavements and footpaths, there is great potential to further lower emissions from our operations.

"We're continually working with concrete suppliers to reduce the amount of pollution and greenhouse gases emitted during the production of concrete for our local roads, and we already use sustainable green concrete for all our footway renewal works – which adds up to 25,000m2 per year."

According to Dr Tommy Wiedmann, Associate Professor of Sustainability Research at UNSW, if all concrete produced in Australia was Geopolymer instead of traditional concrete, this would save 12,000 kiloton CO^2 per year. This is equivalent to taking 4.5 million cars off the road per year, or the total food consumption of 2 million households for one year!

Publications

Anitescu, C., **Atroshchenko, E.**, Alajlan, N., & Rabczuk, T. (2019).
Artificial neural network methods for the solution of second order boundary value problems. Computers, Materials and Continua, 59(1), 345-359. doi:10.32604/cmc.2019.06641

Videla, J., Anitescu, C., Khajah, T., Bordas, S. P. A., & **Atroshchenko, E**. (2019).
h- and p-adaptivity driven by recovery and residual-based error estimators for PHT-splines applied to time-harmonic acoustics. Computers and Mathematics with Applications, 77(9), 2369-2395. doi:10.1016/j.camwa.2018.12.026

Nguyen, H. X., **Atroshchenko, E.**, Ngo, T., Nguyen-Xuan, H., & Vo, T. P. (2019).
Vibration of cracked functionally graded microplates by the strain gradient theory and extended isogeometric analysis. Engineering Structures, 187, 251-266. doi:10.1016/j.engstruct.2019.02.032

Francis, A., Natarajan, S., **Atroshchenko, E.**, Lvy, B., & Bordas, S. P. A. (2019).
A one point integration rule over star convex polytopes. Computers and Structures, 215, 43-64. doi:10.1016/j.compstruc.2019.01.001

Chen, L. L., Lian, H., Liu, Z., Chen, H. B., **Atroshchenko, E.**, & Bordas, S. P. A. (2019).
Structural shape optimization of three dimensional acoustic problems with isogeometric boundary element methods. Computer Methods in Applied Mechanics and Engineering, 355, 926-951. doi:10.1016/j.cma.2019.06.012

Kim, M. Y., Jung, M. R., & **Attard, M. M**. (2019).
Unstrained length-based methods determining an optimized initial shape of 3-dimensional self-anchored suspension bridges. Computers and Structures, 217, 18-35. doi:10.1016/j.compstruc.2019.03.008

O'Shea, D., **Attard, M.M**. And Kellermann, D.C. (2019), "Hyperelastic Constitutive Modelling For Transversely Isotropic Composites and Orthotropic Biological Tissues", International Journal of Solids and Structures Volume 169, September 2019, pp. 1-20, https://doi.org/10.1016/j.ijsolstr.2018.07.013.

Piscesa, B., **Attard, M. M.**, Prasetya, D., & Samani, A. K. (2019).
Modeling cover spalling behavior in high strength reinforced concrete columns using a plasticity-fracture model. Engineering Structures, 196. doi:10.1016/j.engstruct.2019.109336

Bidarmaghz, A., Choudhary, R., Soga, K., Kessler, H., Terrington, R. L., & Thorpe, S. (2019).
Influence of geology and hydrogeology on heat rejection from residential basements in urban areas. Tunnelling and Underground Space Technology, 92. doi:10.1016/j.tust.2019.103068

Lu, H., Liu, A., **Pi, Y. L., Bradford, M. A.**, & Fu, J. (2019).
Lateral-torsional buckling of arches under an arbitrary radial point load in a thermal environment incorporating shear deformations. Engineering Structures, 179, 189-203. doi:10.1016/j.engstruct.2018.10.071

Lu, H., Liu, A., **Pi, Y. L.**, Huang, Y., **Bradford, M. A.**, & Fu, J. (2019).
Flexural-Torsional Buckling of Steel Arches under a Localized Uniform Radial-Load Incorporating Shear Deformations. Journal of Structural Engineering (United States), 145(10). doi:10.1061/(ASCE)ST.1943-541X.0002407

Ataei, A.**, Chiniforush, A. A., Bradford, M., & Valipour, H.** (2019).
Cyclic behaviour of bolt and screw shear connectors in steel-timber composite (STC) beams. Journal of Constructional Steel Research, 161, 328-340. doi:10.1016/j.jcsr.2019.05.048

Zhou, P., Guo, Y. L., **Bradford, M. A., Pi, Y. L.**, & Tong, J. Z. (2019).
Load resistance and hysteretic response of multiple cross-arm pre-tensioned cable stayed buckling-restrained braces. Engineering Structures, 183, 949-964. doi:10.1016/j.engstruct.2019.01.078

Lu, H., Liu, A., **Bradford, M. A., & Pi, Y. L**. (2019).
Experimental investigation of out-of-plane buckling of circular arches under a central radial point load. Thin-Walled Structures, 148. doi:10.1016/j.tws.2019.106198

Le, T., Paradowska, A., **Bradford, M. A**., Liu, X., & **Valipour, H. R**. (2019).
Residual stresses in welded high-strength steel I-Beams. Journal of Constructional Steel Research. doi:10.1016/j.jcsr.2019.105849

Nouri, F., **Bradford, M., & Valipour, H.** (2019).
Steel-Timber Composite Beam-to-Column Connections with Shear Tab. Journal of Structural Engineering (United States), 145(3). doi:10.1061/(ASCE)ST.1943-541X.0002274

Carmichael, D. G. (2019).
Organisations as Systems - Difficulties in Model Development and Validation. Civil Engineering and Environmental Systems, 35(1-4), 41-56. doi:10.1080/10286608.2019.1577395

Mustaffa, N. K., & **Carmichael, D. G.** (2019).
Concreting operationsthe relationship between unit costs and unit emissions. International Journal of Construction Management, 19(5), 427-435. doi:10.1080/15623599.2018.1452095

Carmichael, D. G. (2019).
Bias and decision making an overview systems explanation. Civil Engineering and Environmental Systems, 1-14. doi:10.1080/10286608.2020.1744133

Nasirzadeh, F., **Carmichael, D. G**., Jafar Jarban, M., & Rostamnezhad, M. (2019).
Hybrid Fuzzy-System Dynamics Approach for Quantificatiion of the Impacts of Construction Claims. Engineering, Construction and Architectural Management, 26(7), 1261-1276. doi:10.1108/ECAM-08-2017-0150

Nasirzadeh, F., Ghasem Kashi, M., Khanzadi, M., **Carmichael, D. G**., & Akbarnezhad, A. (2019).
A hybrid approach for quantitative assessment of construction projects risks: The case study of poor quality concrete. Computers and Industrial Engineering, 131, 306-319. doi:10.1016/j.cie.2019.03.045

Carmichael, D. G., Nguyen, T. A., & **Shen, X**. (2019).
Single Treatment of PPP Road Project Options. Journal of Construction Engineering and Management, 145(2), 04018122-1-04018122-11. doi:10.1061/(ASCE)CO.1943-7862.0001591

Carmichael, D. G., Shen, X., & Peansupap, V. (2019).
The relationship between heavy equipment cost efficiency and cleaner production in construction. Journal of Cleaner Production, 211, 521-529. doi:10.1016/j.jclepro.2018.11.167

Khan, I., Xu, T., **Castel, A., & Gilbert, R. I**. (2019).
Early-age tensile creep and shrinkage-induced cracking in internally restrained concrete members. Magazine of Concrete Research, 71(22), 1167-1179. doi:10.1680/jmacr.18.00038

Noushini, A., **Castel, A., & Gilbert, R. I**. (2019).
Creep and shrinkage of synthetic fibre-reinforced geopolymer concrete. Magazine of Concrete Research, 71(20), 1070-1082. doi:10.1680/jmacr.18.00053

Khan, I., Xu, T., **Castel, A., Gilbert, R. I**., & Babaee, M. (2019).
Risk of early age cracking in geopolymer concrete due to restrained shrinkage. Construction and Building Materials, 229. doi:10.1016/j.conbuildmat.2019.116840

Nguyen, Q. D., Khan, M. S. H., **Castel, A**., & **Kim, T**. (2019).
Durability and Microstructure Properties of Low-Carbon Concrete Incorporating Ferronickel Slag Sand and Fly Ash. Journal of Materials in Civil Engineering, 31(8). doi:10.1061/(ASCE)MT.1943-5533.0002797

Li, Q., Wang, Q., Wu, D., **Chen, X., Yu, Y., & Gao, W**. (2019).
Geometrically nonlinear dynamic analysis of organic solar cell resting on Winkler-Pasternak elastic foundation under thermal environment. Composites Part B: Engineering, 163, 121-129. doi:10.1016/j.compositesb.2018.11.022

Yu, Y., Subhani, M., **Dackermann, U**., & Li, J. (2019).
Novel Hybrid Method Based on Advanced Signal Processing and Soft Computing Techniques for Condition Assessment of Timber Utility Poles. Journal of Aerospace Engineering, 32(4). doi:10.1061/(ASCE)AS.1943-5525.0001019

Yu, Y., **Dackermann, U**., Li, J., & Niederleithinger, E. (2019).
Wavelet packet energybased damage identification of wood utility poles using support vector machine multi-classifier and evidence theory. Structural Health Monitoring, 18(1), 123-142. doi:10.1177/1475921718798622

Dackermann, U., Smith, W. A., **Alamdari, M. M**., Li, J., & Randall, R. B. (2019).
Cepstrum-based damage identification in structures with progressive damage. Structural Health Monitoring, 18(1), 87-102. doi:10.1177/1475921718804730

Douglas, K. J., Fell, R., Peirson, W. L., & Studholme, H. (2019).
Experimental investigation of global backward erosion and suffusion of soils in embankment dams. Canadian Geotechnical Journal, 56(6), 789-807. doi:10.1139/cgj-2018-0088

Savage, S., **Douglas, K.**, **Fell, R.**, Peirson, W., & Berndt, R. (2019).
Modeling the Erosion and Swelling of the Sides of Transverse Cracks in Embankment Dams. Journal of Geotechnical and Geoenvironmental Engineering, 145(5). doi:10.1061/(ASCE)GT.1943-5606.0002040

Eisentraeger, S (nee Duczek) & Duvigneau, F. (2019).
Highorder shape functions for interior acoustics. PAMM, 19(1). doi:10.1002/pamm.201900010

He, K., **Fell, R.**, & **Song, C**. (2019).
Transverse cracking in embankment dams resulting from cross-valley differential settlements. European Journal of Environmental and Civil Engineering. doi:10.1080/19648189.2019.1691663

Foster, S. J., & Parvez, A. (2019).
Assessment of model error for reinforced concrete beams with steel fibers in bending. Structural Concrete. doi:10.1002/suco.201800090

Cheng, J., Liu, Z., Qian, Y., **Wu, D.**, Zhou, Z., **Gao, W.**, . . . Tan, J. (2019).
Robust optimization of uncertain structures based on interval closeness coefficients and the 3D violation vectors of interval constraints. Structural and Multidisciplinary Optimization, 60(1), 17-33. doi:10.1007/s00158-019-02273-z

Liu, Z., Cheng, J., Yang, M., Yuan, P., Qiu, C., **Gao, W.**, & Tan, J. (2019).
Isogeometric analysis of large thin shell structures based on weak coupling of substructures with unstructured T-splines patches. Advances in Engineering Software, 135. doi:10.1016/j.advengsoft.2019.102692

Li, W., Ma, H., & **Gao, W**. (2019).
A higher-order shear deformable mixed beam element model for accurate analysis of functionally graded sandwich beams. Composite Structures, 221. doi:10.1016/j.compstruct.2019.04.002

Huang, Y., Liu, A., Zhu, C., Lu, H., & **Gao, W**. (2019).
Experimental and numerical investigations on out-of-plane ultimate resistance of parallel twin-arch under uniform radial load. Thin-Walled Structures, 135, 147-159. doi:10.1016/j.tws.2018.10.042

Li, K., **Wu, D.**, & **Gao, W**. (2019).
Spectral stochastic isogeometric analysis for linear stability analysis of plate. Computer Methods in Applied Mechanics and Engineering, 352, 1-31. doi:10.1016/j.cma.2019.04.009

Li, W., **Gao, W.**, Xie, P., & Chen, S. (2019).
A simplified-but-general nonlinear thin-walled beam finite element model with independent interpolated axial displacement. Thin-Walled Structures, 148. doi:10.1016/j.tws.2019.106467

Huang, Y. Q., Fu, J. Y., Liu, A. R., **Pi, Y. L.**, **Wu, D.**, & **Gao, W**. (2019).
Effect of concrete creep on dynamic stability behavior of slender concrete-filled steel tubular column. Composites Part B: Engineering, 157, 173-181. doi:10.1016/j.compositesb.2018.08.117

Wu, D., Liu, A., Huang, Y., Huang, Y., **Pi, Y., & Gao, W**. (2019).
Time dependent uncertain free vibration analysis of composite CFST structure with spatially dependent creep effects. Applied Mathematical Modelling, 75, 589-606. doi:10.1016/j.apm.2019.05.047

Feng, J., Li, Q., Sofi, A., Li, G., **Wu, D.**, & **Gao, W**. (2019).
Uncertain Structural Free Vibration Analysis with Non-Probabilistic Spatially Varying Parameters. ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part B: Mechanical Engineering, 5(2). doi:10.1115/1.4041501

Feng, J., Liu, L., **Wu, D.**, Li, G., Beer, M., & **Gao, W**. (2019).
Dynamic reliability analysis using the extended support vector regression (X-SVR). Mechanical Systems and Signal Processing, 126, 368-391. doi:10.1016/j.ymssp.2019.02.027

Liu, Z., Yang, C., **Gao, W.**, **Wu, D.**, & Li, G. (2019).
Nonlinear behaviour and stability of functionally graded porous arches with graphene platelets reinforcements. International Journal of Engineering Science, 137, 37-56. doi:10.1016/j.ijengsci.2018.12.003

Yu, Y., Chen, X., Gao, W., **Wu, D.**, & **Castel, A**. (2019).
Modelling non-isothermal chloride ingress in unsaturated cement-based materials. Construction and Building Materials, 217, 441-455. doi:10.1016/j.conbuildmat.2019.05.078

Yu, Y., Chen, X., Gao, W., **Wu, D.**, & **Castel, A**. (2019).
Impact of atmospheric marine environment on cementitious materials. Corrosion Science, 148, 366-378. doi:10.1016/j.corsci.2018.12.021

Huang, Y., Fu, J., **Wu, D**., Liu, A., **Gao, W., & Pi, Y**. (2019).
Dynamic Stability of Slender Concrete-Filled Steel Tubular Columns with General Supports. International Journal of Structural Stability and Dynamics, 19(4). doi:10.1142/S0219455419500457

Li, K., **Wu, D**., **Gao, W**., & **Song, C**. (2019).
Spectral stochastic isogeometric analysis of free vibration. Computer Methods in Applied Mechanics and Engineering, 350, 1-27. doi:10.1016/j.cma.2019.03.008

Gao, K., **Gao, W**., Wu, B., & **Song, C**. (2019).
Nondeterministic dynamic stability assessment of EulerBernoulli beams using Chebyshev surrogate model. Applied Mathematical Modelling, 66, 1-25. doi:10.1016/j.apm.2018.09.007

Li, Q., **Wu, D**., **Gao, W., Tin-Loi, F**., Liu, Z., & Cheng, J. (2019).
Static bending and free vibration of organic solar cell resting on Winkler-Pasternak elastic foundation through the modified strain gradient theory. European Journal of Mechanics, A/Solids, 78. doi:10.1016/j.euromechsol.2019.103852

Feng, Y., **Gao, W**., **Wu, D**., & **Tin-Loi, F**. (2019).
Machine learning aided stochastic elastoplastic analysis. Computer Methods in Applied Mechanics and Engineering, 357. doi:10.1016/j.cma.2019.112576

Wu, D., Wang, Q., Liu, A., **Yu, Y**., Zhang, Z., & **Gao, W**. (2019).
Robust free vibration analysis of functionally graded structures with interval uncertainties. Composites Part B: Engineering, 159, 132-145. doi:10.1016/j.compositesb.2018.09.082

Yu, Y., **Wu, D**., Wang, Q., **Chen, X., & Gao, W.** (2019).
Machine learning aided durability and safety analyses on cementitious composites and structures. International Journal of Mechanical Sciences, 160, 165-181. doi:10.1016/j.ijmecsci.2019.06.040

Mazumder, M. H., & **Gilbert, R. I.** (2019).
Finite element modelling of bond-slip at anchorages of reinforced concrete members subjected to bending. SN APPLIED SCIENCES, 1(11), 11 pages. doi:10.1007/s42452-019-1368-5

Amin, A., & **Ian Gilbert, R.** (2019).
Steel fiber-reinforced concrete beamsPart II: Strength, ductility, and design. ACI Structural Journal, 116(2), 113-123. doi:10.14359/51713289

Watts, M. J., Amin, A., **Gilbert, R. I**., & Kaufmann, W. (2019).
Behavior of fiber reinforced concrete members under sustained axial/flexural load. Structural Concrete. doi:10.1002/suco.201900227

Gilbert, R.I. and Amin, A. (2019),
"Time-dependent behaviour of fibre reinforced concrete", Concrete in Australia, Vol. 45, No. 1, pp. 31-38.

Amin, A., & **Gilbert, R. I**. (2019).
Steel fiber-reinforced concrete beamsPart I: Material characterization and in-service behavior. ACI Structural Journal, 116(2), 101-111. doi:10.14359/51713288

Kristombu Baduge, S., Mendis, P., San Nicolas, R., Nguyen, K., & **Hajimohammadi, A**. (2019).
Performance of lightweight hemp concrete with alkali-activated cenosphere binders exposed to elevated temperature. Construction and Building Materials, 224, 158-172. doi:10.1016/j.conbuildmat.2019.07.069

Hajimohammadi, A., Ngo, T., & Vongsvivut, J. (2019).
Interfacial chemistry of a fly ash geopolymer and aggregates. Journal of Cleaner Production, 231, 980-989. doi:10.1016/j.jclepro.2019.05.249

Liu, L., Miramini, S., & **Hajimohammadi, A**. (2019).
Characterising fundamental properties of foam concrete with a non-destructive technique. Nondestructive Testing and Evaluation, 34(1), 54-69. doi:10.1080/10589759.2018.1525378

Hajimohammadi, A., Ngo, T., Provis, J. L., **Kim, T**., & Vongsvivut, J. (2019).
High strength/density ratio in a syntactic foam made from one-part mix geopolymer and cenospheres. Composites Part B: Engineering, 173. doi:10.1016/j.compositesb.2019.106908

Huang, Q., & **Hamed, E**. (2019).
Nonlinear finite element analysis of composite precast concrete sandwich panels made with diagonal FRP bar connectors. Composite Structures, 212, 304-316. doi:10.1016/j.compstruct.2019.01.019

Kashani, A., Ngo, T. D., & Mendis, P. (2019).
The effects of precursors on rheology and self-compactness of geopolymer concrete. Magazine of Concrete Research, 71(11), 557-566. doi:10.1680/jmacr.17.00495

Nguyen, T., **Kashani, A**., Ngo, T., & Bordas, S. (2019). Deep neural network with high-order neuron for the prediction of foamed concrete strength. Computer-Aided Civil and Infrastructure Engineering, 34(4), 316-332. doi:10.1111/mice.12422

Sinaie, S., Ngo, T. D., **Kashani, A**., & Whittaker, A. S. (2019).
Simulation of cellular structures under large deformations using the material point method. International Journal of Impact Engineering, 134. doi:10.1016/j.ijimpeng.2019.103385

Kashani, A., Ngo, T. D., & **Hajimohammadi, A**. (2019).
Effect of recycled glass fines on mechanical and durability properties of concrete foam in comparison with traditional cementitious fines. Cement and Concrete Composites, 99, 120-129. doi:10.1016/j.cemconcomp.2019.03.004

Song, X., & **Khalili, N**. (2019).
A peridynamics model for strain localization analysis of geomaterials. International Journal for Numerical and Analytical Methods in Geomechanics, 43(1), 77-96. doi:10.1002/nag.2854

Khoshghalb, A., Ghaffaripour, O., Zamani, K., & Tootoonchi, A. (2019).
Code verification in computational geomechanics: Method of manufactured solutions (MMS). Computers and Geotechnics, 116. doi:10.1016/j.compgeo.2019.103178

Li, H., Senetakis, K., & **Khoshghalb, A**. (2019).
On the small-strain stiffness of polypropylene fibre-sand mixtures. Geosynthetics International, 26(1), 66-80. doi:10.1680/jgein.18.00037

Pasha, A. Y., **Khoshghalb, A., & Khalili, N**. (2019).
Can degree of saturation decrease during constant suction compression of an unsaturated soil?. Computers and Geotechnics, 106, 199-204. doi:10.1016/j.compgeo.2018.10.015

Ghaffaripour, O., Esgandani, G. A., **Khoshghalb, A., & Shahbodaghkhan, B**. (2019).
Fully coupled elastoplastic hydro-mechanical analysis of unsaturated porous media using a meshfree method. International Journal for Numerical and Analytical Methods in Geomechanics. doi:10.1002/nag.2931

Kim, T., Hu, Q., Ley, M. T., Aboustait, M., & Bullard, J. W. (2019).
Using particle characterization to study fly ash dissolution and leaching in water and KOH solution. ACI Materials Journal, 116(4), 5-17. doi:10.14359/51716676

Mahanama, D., De Silva, P., **Kim, T., Castel, A**., & Khan, M. S. H. (2019).
Evaluating Effect of GGBFS in Alkali-Silica Reaction in Geopolymer Mortar with Accelerated Mortar Bar Test. Journal of Materials in Civil Engineering, 31(8). doi:10.1061/(ASCE)MT.1943-5533.0002804

Kim, T., Alnahhal, M. F., Nguyen, Q. D., Panchmatia, P., **Hajimohammadi, A**., **& Castel, A**. (2019).
Initial sequence for alkali-silica reaction: Transport barrier and spatial distribution of reaction products. Cement and Concrete Composites, 104, 103378. doi:10.1016/j.cemconcomp.2019.103378

Liu, L., Lim, S., **Shen, X**., & Yebra, M. (2019).
A hybrid method for segmenting individual trees from airborne lidar data. Computers and Electronics in Agriculture, 163. doi:10.1016/j.compag.2019.104871

Liu, L., Lim, S., **Shen, X**., & Yebra, M. (2019).
A multiscale morphological algorithm for improvements to canopy height models. Computers and Geosciences, 130, 20-31. doi:10.1016/j.cageo.2019.05.012

MakkiAlamdari, M., Anaissi, A., Khoa, N. L. D., & Mustapha, S. (2019).
Frequency domain decomposition-based multisensor data fusion for assessment of progressive damage in structures. Structural Control and Health Monitoring, 26(2). doi:10.1002/stc.2299

Alamdari, M. M., Dang Khoa, N. L., Wang, Y., Samali, B., & Zhu, X. (2019).
A multi-way data analysis approach for structural health monitoring of a cable-stayed bridge. Structural Health Monitoring, 18(1), 35-48. doi:10.1177/1475921718790727

Anaissi, A., Khoa, N. L. D., Rakotoarivelo, T., **Alamdari, M. M**., & Wang, Y. (2019).
Smart pothole detection system using vehicle-mounted sensors and machine learning. Journal of Civil Structural Health Monitoring, 9(1), 91-102. doi:10.1007/s13349-019-00323-0

A. Chiniforush, A**., Makki Alamdari, M., Dackermann, U., Valipour, H. R**., & Akbarnezhad, A. (2019).
Vibration behaviour of steel-timber composite floors, part (1): Experimental & numerical investigation. Journal of Constructional Steel Research, 161, 244-257. doi:10.1016/j.jcsr.2019.07.007

Alamdari, M. M., Ge, L., Kildashti, K., Zhou, Y., Harvey, B., & Du, Z. (2019).
Non-contact structural health monitoring of a cable-stayed bridge: case study. Structure and Infrastructure Engineering, 15(8), 1119-1136. doi:10.1080/15732479.2019.1609529

Alamdari, M. M., Kildashti, K., Samali, B., & **Valipour, H** (2019).
Damage diagnosis in bridge structures using rotation influence line: Validation on a cable-stayed bridge. Engineering Structures, 185, 1-14. doi:10.1016/j.engstruct.2019.01.124

Sufian, A., **Russell, A. R.**, & Whittle, A. J. (2019).
Evolving pore orientation, shape and size in sheared granular assemblies. Granular Matter, 21(1). doi:10.1007/s10035-018-0856-4

Aliabadian, Z., Zhao, G. F., & **Russell, A. R**. (2019).
Crack development in transversely isotropic sandstone discs subjected to Brazilian tests observed using digital image correlation. International Journal of Rock Mechanics and Mining Sciences, 119, 211-221. doi:10.1016/j.ijrmms.2019.04.004

Zhao, G. F., Yin, Q., **Russell, A. R.**, Li, Y., Wu, W., & Li, Q. (2019).
On the linear elastic responses of the 2D bonded discrete element model. International Journal for Numerical and Analytical Methods in Geomechanics, 43(1), 166-182. doi:10.1002/nag.2858

Aliabadian, Z., Zhao, G. F., & **Russell, A. R**. (2019).
Failure, crack initiation and the tensile strength of transversely isotropic rock using the Brazilian test. International Journal of Rock Mechanics and Mining Sciences, 122. doi:10.1016/j.ijrmms.2019.104073

Zhao, G. F., Lian, J., **Russell, A., & Khalili, N**. (2019).
Implementation of a modified DruckerPrager model in the lattice spring model for plasticity and fracture. Computers and Geotechnics, 107, 97-109. doi:10.1016/j.compgeo.2018.11.021

Guo, H., Ooi, E. T., **Saputra, A. A.**, Yang, Z., Natarajan, S., Ooi, E. H., & **Song, C**. (2019).
A quadtree-polygon-based scaled boundary finite element method for image-based mesoscale fracture modelling in concrete. Engineering Fracture Mechanics, 211, 420-441. doi:10.1016/j.engfracmech.2019.02.021

Zhang, Z., Liu, Y., Dissanayake, D. D., **Saputra, A. A., & Song, C**. (2019).
Nonlocal damage modelling by the scaled boundary finite element method. Engineering Analysis with Boundary Elements, 99, 29-45. doi:10.1016/j.enganabound.2018.10.006

Oka, F., **Shahbodagh, B.**, & Kimoto, S. (2019).
A computational model for dynamic strain localization in unsaturated elasto-viscoplastic soils. International Journal for Numerical and Analytical Methods in Geomechanics, 43(1), 138-165. doi:10.1002/nag.2857

Wang, F., Zheng, X. Z., Li, N., & **Shen, X**. (2019).
Systemic vulnerability assessment of urban water distribution networks considering failure scenario uncertainty. International Journal of Critical Infrastructure Protection, 26. doi:10.1016/j.ijcip.2019.05.002

Hirshikesh., Pramod, A. L. N., Annabattula, R. K., Ooi, E. T., **Song, C.**, & Natarajan, S. (2019).
Adaptive phase-field modeling of brittle fracture using the scaled boundary finite element method. Computer Methods in Applied Mechanics and Engineering, 355, 284-307. doi:10.1016/j.cma.2019.06.002

Song, C., Qu, Y., Liu, L., & Chen, D. (2019).
A review of numerical methods for far-field modeling in dynamic soil-structure interaction systems. Shuili Fadian Xuebao/Journal of Hydroelectric Engineering, 38(9), 1-17. doi:10.11660/slfdxb.20190901

Zhang, J., & **Song, C**. (2019).
A polytree based coupling method for non-matching meshes in 3D. Computer Methods in Applied Mechanics and Engineering, 349, 743-773. doi:10.1016/j.cma.2019.02.038

Aladurthi, L. N. P., Natarajan, S., Ooi, E. T., & **Song, C**. (2019).
Scaled boundary finite element method for compressible and nearly incompressible elasticity over arbitrary polytopes. International Journal for Numerical Methods in Engineering, 119(13), 1379-1394. doi:10.1002/nme.6095

Xing, W., Zhang, J., **Song, C., & Tin-Loi**, F. (2019).
A node-to-node scheme for three-dimensional contact problems using the scaled boundary finite element method. Computer Methods in Applied Mechanics and Engineering, 347, 928-956. doi:10.1016/j.cma.2019.01.015

Liu, L., Zhang, J., **Song, C**., Birk, C., **Saputra, A. A., & Gao, W**. (2019). Automatic three-dimensional acoustic-structure interaction analysis using the scaled boundary finite element method. Journal of Computational Physics, 395, 432-460. doi:10.1016/j.jcp.2019.06.033

Liu, L., Zhang, J., **Song, C**., Birk, C., & **Gao, W**. (2019). An automatic approach for the acoustic analysis of three-dimensional bounded and unbounded domains by scaled boundary finite element method. International Journal of Mechanical Sciences, 151, 563-581. doi:10.1016/j.ijmecsci.2018.12.018

Wang, Q., **Wu, D**., **Tin-Loi, F., & Gao, W**. (2019). Machine learning aided stochastic structural free vibration analysis for functionally graded bar-type structures. Thin-Walled Structures, 144. doi:10.1016/j.tws.2019.106315

Vahab, M., & Khalili, N. (2019). A super-convergent staggered algorithm for the simulation of hydraulic fracturing treatments. International Journal of Fracture, 217(1-2), 49-64. doi:10.1007/s10704-019-00362-0

Vahab, M., Khoei, A. R., & **Khalili, N**. (2019). An X-FEM technique in modeling hydro-fracture interaction with naturally-cemented faults. Engineering Fracture Mechanics, 212, 269-290. doi:10.1016/j.engfracmech.2019.03.020

Hirmand, M. R., **Vahab, M**., Papoulia, K. D., & **Khalili, N**. (2019). Robust simulation of dynamic fluid-driven fracture in naturally fractured impermeable media. Computer Methods in Applied Mechanics and Engineering, 357. doi:10.1016/j.cma.2019.112574

Nouri, F., & **Valipour, H. R**. (2019). Semi-rigid partial-strength steel-timber composite (STC) connections with mechanically anchored steel rods. Journal of Constructional Steel Research, 158, 560-575. doi:10.1016/j.jcsr.2019.04.017

Ataei, A., **Valipour, H. R., Bradford, M. A., &** Chiniforush, A. A**.** (2019). Experimental study of steel-timber composite beam-to-column joints with extended end plates. Construction and Building Materials, 226, 636-650. doi:10.1016/j.conbuildmat.2019.07.154

Hassanieh, A., Chiniforush, A. A.**, Valipour, H. R., & Bradford, M. A.** (2019). Vibration behaviour of steel-timber composite floors, part (2): Evaluation of human-induced vibrations. Journal of Constructional Steel Research, 158, 156-170. doi:10.1016/j.jcsr.2019.03.026

Nouri, F., **Valipour, H. R., & Bradford, M. A**. (2019). Finite element modelling of steel-timber composite beam-to-column joints with nominally pinned connections. Engineering Structures, 201. doi:10.1016/j.engstruct.2019.109854

Nouri, F., **Valipour, H. R., & Bradford, M. A**. (2019). Structural behaviour of steel-timber composite (STC)beam-to-column connections with double angle web cleats subjected to hogging bending moment. Engineering Structures, 192, 1-17. doi:10.1016/j.engstruct.2019.04.092

Masoumi, S., Zare, S., **Valipour, H**., & Abdolhosseini Qomi, M. J. (2019). Effective interactions between calcium-silicate-hydrate nanolayers. Journal of Physical Chemistry C. doi:10.1021/acs.jpcc.8b08146

Chiniforush, A. A**., Valipour, H**., & Akbarnezhad, A. (2019). Water vapor diffusivity of engineered wood: Effect of temperature and moisture content. Construction and Building Materials, 224, 1040-1055. doi:10.1016/j.conbuildmat.2019.08.013

Chiniforush, A. A., Akbarnezhad, A., **Valipour, H**., & Malekmohammadi, S. (2019). Moisture and temperature induced swelling/shrinkage of softwood and hardwood glulam and LVL: An experimental study. Construction and Building Materials, 207, 70-83. doi:10.1016/j.conbuildmat.2019.02.114

Chiniforush, A. A**., Valipour, H. R., Bradford, M. A**., & Akbarnezhad, A. (2019). Long-term behaviour of steel-timber composite (STC) shear connections. Engineering Structures, 196. doi:10.1016/j.engstruct.2019.109356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