

International Symposium on Reliability Engineering and Risk Management Hannover, Germany, 4 - 7 September 2022

PROGRAM

Michael Beer (Conference General Chair)

Enrico Zio (Conference General Co-Chair)

Kok-Kwang Phoon (Conference General Co-Chair)

Bilal M. Ayyub (Conference General Co-Chair)

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Program Overview

	Sunday 4th September, 2022	Room
18:00-21:00	Registration	1403
18:00-21:00	Icebreaker / Reception	1403
	Monday 5th September, 2022	
8:30	Opening Ceremony	401
9:30	Ang Lecture: Prof. Yan-Gang Zhao	401
10:30	Coffee Break	1403
11:00	Plenary Lecture: Prof. Jim Hall FREng	401
11:40	Plenary Lecture: Prof. Mahmoud Reda Taha	401
12:20	Lunch	1403
13:50	Parallel Sessions (4 parallel sessions, 5 papers per session)	Session Rooms
15:30	Coffee Break	1403
16:00	Parallel Sessions (4 parallel sessions, 5 papers per session)	Session Rooms
	Tuesday 6th September, 2022	
8:30	Plenary Lecture: Prof. Mark G. Stewart	401
9:20	Parallel Sessions (5 parallel sessions, 3 papers per session)	Session Rooms
10:20	Coffee Break	1403
10:50	Parallel Sessions (5 parallel sessions, 4 papers per session)	Session Rooms
12:10	Lunch	1403
13:40	Plenary Lecture: Prof. Hongwei Huang	401
14:30	Parallel Sessions (4 parallel sessions, 3 papers per session)	Session Rooms
15:30	Coffee Break	1403
16:00	Parallel Sessions (4 parallel sessions, 5 papers per session)	Session Rooms
18:30	Conference Dinner and Award Ceremony	1403
	Wednesday 7th September, 2022	
8:30	Plenary Lecture: Prof. Xiaobo Qu	401
9:20	Parallel Sessions (5 parallel sessions, 3 papers per session)	Session Rooms
10:20	Coffee Break	1403
10:50	Parallel Sessions (5 parallel sessions, 4 papers per session)	Session Rooms
12:10	Lunch	1403
13:40	Plenary Lecture: Dr. Mohammad Pourgol-Mohammad	401
14:30	Parallel Sessions (3 parallel sessions, 3 papers per session)	Session Rooms
15:30	Coffee Break	1403
16:00	Parallel Sessions (1 session, 3 papers per session)	Session Rooms
17:40	Closing Session	401

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Preface

The 8th edition of the International Symposium on Reliability Engineering and Risk Management (ISRERM) is held in Hannover, Germany, on 4 - 7 September 2022. ISRERM is a bi-annual international conference on topics which cross several engineering and civil disciplines, with the aim to advance the reliability engineering and risk management fields jointly with synergetic developments in applications.

ISRERM was jointly established by Professor Jie Li and Professor Yan-Gang Zhao, with support from Professor Alfredo Ang in 2008, to promote the scientific development and innovative application of reliability-based, risk-based, and other uncertainty-informed decision making theories and practices for addressing safety-related aspects in the design, operation and management of engineering systems, throughout their lifecycle.

The symposium has previously been held in Tongji University, Shanghai, China (2008, 2010), Kanagawa University, Yokohama, Japan (2012), National Taiwan University of Science & Technology, Taiwan (2014), Yonsei University, Seoul, South Korea (2016), National University of Singapore, Singapore (2018) and Beijing University of Technology, China (2020).

Over the years, ISRERM has attracted increasing attention and participants from the expert communities interested in the reliability and risk fields, worldwide. To accommodate this evolution, we expand the exposure of ISRERM by bringing it to Europe for the first time. To effectively do so, we co-organize ISRERM 2022 with representatives of the Asian, European and American communities involved in the reliability and risk fields. With ISRERM 2022, we are laying the first stone for the interconnection of the expert communities at the international level to explore the establishment of a global scientific Alliance for Safety and Reliability. To facilitate the building of the interconnection, the symposium integrates the support and participation of the European Safety and Reliability Association (ESRA), the ASCE Infrastructure Resilience Division (IRD), the ASME Safety Engineering & Risk Analysis Division (SERAD), the Liverpool Institute for Risk and Uncertainty, the International Joint Research Center for Engineering Reliability and Stochastic Mechanics (JCERSM), and the International Joint Research Center for Resilient Infrastructure (ICRI) of Tongji University. The keynote lectures at ISRERM reflect this exposure further, with speakers of international excellence from Asia, Europe, America and Australia.

From the technical activity point of view, the objective of ISRERM 2022 is to provide an all-around inspiring environment and a multi-disciplinary forum for the exchange of knowledge and expertise on theories and methods in the field of Reliability Engineering and Risk Management, and on their application to a wide range of industrial and civil problem areas.

Digital transformation has gathered pace in all industries and there are exciting opportunities for breaking completely new grounds in analytics by machine learning, in decision making by human-machine collaborative decision making, and in the deployment of cyber-physical systems by IoT. ISRERM 2022 is serving as a launch pad for reliability engineering and risk management to go to the next level.

On another side, the 2020 pandemic has also brought great urgency to develop societies in a sustainable and just way. Reliability engineering and risk management have a role to play in the development agenda at large, because of the increasing importance to ensure the safe and proper functionality of technological and industrial systems, as the basis for further sustainable economic and societal development. With regards to this, the conference provides an academic and industrial platform to discuss such challenges and their solutions across various engineering disciplines, such as civil, mechanical, energy, aerospace and aeronautics, offshore and marine, and others.

The rich program of the conference offers the dedicated Alfredo Ang Lecture by Professor Yan-Gang Zhao, 6 keynote lectures, 26 sessions with 4 parallel tracks for a total of 125 papers from 25 countries, selected by an expert technical committee after rigorous peer-review. And for our young to-be researchers of the next generation, ISRERM features the best student paper awards. The symposium will be held in a hybrid form to facilitate global participation despite COVID restrictions. We hope that the next ISRERM can be held in presence completely.

As conference Chairmen, we look forward to the stimulating presentations at ISRERM 2022 and the technical discussions which will emerge from them, and recognize that the success of a symposium like ISRERM depends on the contributions of many individuals and organizations, who believe in the substantial scientific and technical work that makes up the program and the event. For this reason, we first of all deeply thank all the authors who have contributed their work to the conference: the quality of submissions was extremely high and we feel gratified by the resulting high quality of the program. The organizing committee would also like to express the deepest appreciation to the keynote speakers, all members of the various committees, the minisymposia organizers and the session chairs for their strong support to the conference preparation and development.

We certainly also highly appreciate the strong financial support by the European Safety and Reliability Association (ESRA).

Finally, we thank all of you participants who have come to live the conference: we sincerely hope you find the program stimulating and enjoyable!

Michael Beer Enrico Zio Kok Kwang Phoon Bilal M. Ayyub





Organizers

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Organizers & Sponsors

Leibniz Universität Hannover

Organizer

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Leibniz Universität Hannover

At Leibniz University there are currently almost 30,000 students studying in nine faculties, and some 3,100 researchers working in more than 180 institutes. The main building of the university is the Royal Palace Welfenschloss at the Welfengarten. Our internationally visible core research topics are in mechanical engineering, in quantum optics and gravitational physics, biomedical research and teacher training. The broad range of subjects at Leibniz University is entirely compatible with an overall university strategy of raising its profile, in particular in teaching and research, including the establishment and enhancement of research priority areas originating in the humanities and social sciences. Cooperation agreements with national and international partners strengthen our scientific expertise – our most important partner is Hannover Medical School (MHH). By adopting the name of the polymath Gottfried Wilhelm Leibniz in 2006, the university committed itself to unity in its diversity.

www.uni-hannover.de



Organizer

Institute for Risk and Reliability

INSTITUTE FOR RISK AND RELIABILITY

Engineering structures, infrastructure and systems are characterized by a rapid growth in scale, complexity and interconnection. As a result the gap between required and available information for numerical modeling is growing quickly as well, so that uncertainties and risks are involved in our models and analyses to a greater extent than ever before. Since our engineering structures, infrastructure and systems are, to a significant extent, critical for the functionality of our economic and societal life, they require proper approaches and measures to verify and ensure their reliable performance. Our research is focused on developing new theories, techniques and practical solutions to address this challenge with a combination of efficient computational modeling and advanced uncertainty quantification. Our research staff includes thirteen doctoral candidates, four postdocs and eight guest researchers for the year 2022 – 2023. Moreover, our institute is involved in six ongoing research projects funded by the German Research Foundation and the European Commission. Our research areas include Reliability and Robustness of Structures, Performance, Risk and Resilience of Complex Systems and Networks, Risk Reduction in Vague and Changing Environments, Planning and Simulation for Transportation Operations.

www.irz.uni-hannover.de



European Safety and Reliability Association Collaborator



The European Safety and Reliability Association is a non-profit international association for the advance and application of safety and reliability technology in all areas of human endeavor. It is an "umbrella" organization with a membership consisting more than 100 national professional societies, industrial organizations and higher education institutions. The common interest is safety and reliability. ESRA established the ESREL conference series, and is a co-organiser of each conference.

www.esrahomepage.eu



Liverpool Institute for Risk and Uncertainty

Collaborator



Institute for Risk UNIVERSITY OF and Uncertainty

LIVERPOOL

The Institute for Risk and Uncertainty is a component of the Faculty of Science and Engineering at the University of Liverpool. Established in 1881, the university has a reputation for outstanding research in computer science, general engineering, chemistry, architecture, clinical medicine, among other fields.

The Risk Institute is a unique concentration of expertise across many disciplines from different faculties including engineering, physical and life sciences, management, and social sciences. Its research focuses on inventing methods and fashioning tools for the coherent quantification and management of risks and uncertainties that arise in complex environments and natural and constructed systems. The core staff at the Risk Institute has authored hundreds of scholarly papers which have generated over 27 thousand citations collectively.

The Risk Institute is a unique national centre of excellence in risk and uncertainty research. It hosts the only centre for doctoral training in the UK focusing on risk and uncertainty. Currently, there are over sixty PhD researchers engaged in research projects motivated by interaction with industrial partners. This research is funded primarily by EPSRC and ESRC and various other national laboratories, industrial firms, governmental agencies, and NGOs.

www.riskinstitute.uk



Risk and Resilience Measurements Committee of the ASCE Infrastructure Resilience Division

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International Joint Research Center for Resilient Infrastructure

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jcersm.tongji.edu.cn





Alfredo Ang Lecture

To Alfredo H-S. Ang for notable and pioneering contributions to the development of rational safety criteria for the design of structures by applying probabilistic methodology and for his dedicated service to his profession.

During his career, both here at Illinois and then at Irvine, Ang has combined academic research and teaching in several aspects of structural mechanics and structural engineering. His major effort has been directed toward structural safety by applying probability and reliability concepts in structural engineering. He has made significant pioneering contributions to probability-based safety analysis and design applied to a variety of problems in structural engineering.

He is the author or co-author of more than 300 publications and was senior author on a two-volume textbook, Probability Concepts in Engineering Planning and Design, which has been translated into several languages and adopted by major universities worldwide. An active teacher, he developed both undergraduate and graduate courses in probabilistic methods, lectured extensively, and organized seminars and short courses.

Ang extended his theoretical work to practical problems, including seismic hazard analysis, earthquake engineering, wind engineering, offshore structures, and life-cycle cost effectiveness in design criteria development including optimal design of complex structures. As a consultant and technical adviser, he has served numerous governmental and industrial organizations, both in the United States and abroad.

His research work on safety criteria has had a major impact on engineering specifications and practice. He has served the American Society of Civil Engineers (ASCE) for many years and in many positions, including international director of the board and chair of several committees. He is also an Honorary Member of ASCE and has received the Nathan M. Newmark and Alfred М Freudenthal medals. E. Ho-Award, ward and numerous other awards from ASCE. He is a Fellow of the American Society of Mechanical Engineers and Associate Fel-



low of the American Institute of Aeronautics and Astronautics.

Since 1983, he has been the chair of the executive board of the International Conference on Structural Safety and Reliability. He also continues to serve as honorary consultant to the Chinese Academy of Building Research and distinguished visiting professor at the Institute of Engineering Mechanics, Academia Sinica, Harbin, China. Ang is a member of the National Academy of Engineering elected in 1976.

The Executive Board of ISRERM proposed to establish the Alfredo Ang Lecture in honour of Professor Alfredo H.-S. Ang in June 2017. Given Professor Ang's leadership role in the development of ISRERM, the Executive Board of ISRERM felt that it is appropriate to host the Alfredo Ang Lecture as the lead lecture in all future ISRERM, starting with the 6th ISRERM. The Alfredo Ang Lecture will further strengthen ISRERM's position as one of the premium venue to share research and practice in this burgeoning field and would bring greater visibility to the body of work on how engineering contributes to the building of safer and more resilient communities.

Plenary Speakers

Alfredo Ang Lecture

Prof. Yan-Gang Zhao

Department of Architecture, Kanagawa University, Yokohama, Japan

Structural Reliability Assessment with Uncertain Distribution Parameters

It has been recognized that the uncertainty of distribution parameters has a significant effect on the structural reliability analysis results. In this paper, an efficient and accurate method is proposed to estimate the predictive failure probability including the uncertainty of distribution parameters. This method



obtains the predictive failure probability by integrating in the probability space of the conditional reliability index. A three-parameter lognormal distribution is suggested to approach the distribution of the conditional reliability index, in which the first-three central moments of the conditional reliability index are estimated from the point-estimate method combined with the bivariate dimension-reduction method. On basis of this, the analytical solutions for the quantiles and probability distribution of the conditional failure probability are derived and investigated. It is found that the proposed method uses only one calculation process to obtain the predictive failure probability and the quantiles of conditional failure probability, which saves the calculation time using two calculation processes in previous methods, it is easy to provide a complete picture of structural reliability evaluation results under distribution parameter uncertainty efficiently in a wide range of applications.

BIOGRAPHY

Yan-Gang Zhao is a professor and the current chair of Dept. of Architecture, Graduate School of Kanagawa University, Japan. He is also a pluralistic distinguished professor of Beijing University of Technology. His research interests are mainly on stochastic dynamic structural analysis and structural reliability theory, especially on system reliability analysis, dynamic reliability evaluation and structural reliability analyses based on methods of high order moments. Prof. Zhao is the author or co-author of four books, including Structural Reliability: Approaches from Perspectives of Statistical Moments, Yan-Gang Zhao & Zhao-Hui Lu, Wiley-BlackWell, 2021, and more than 200 articles in various technical journals, such as ASCE journal of Structural Engineering,

ASCE journal of Engineering Mechanics, Earthquake Engineering and Engineering Dynamics. He has chaired and participated in more than 20 research projects including Key projects of the Natural Science Foundation of China, projects of Grant-in-aid from Ministry of Science and Education of Japan. Prof. Zhao is a member of a number of national and international committees and associations that focus on risk and reliability analysis. He received the Tokai Research Award of the Architecture Institute of Japan in1997 and the JAABE best paper award by the Architecture Institutes of Japan, Korea and China in 2003. In 2008, he received the Research Prize of Architecture Institute of Japan. In 2019, he become a foreign associate of the engineering academy of Japan.

Keynote Lectures

Prof. Jim Hall FREng

Professor of Climate and Environmental Risk, School of Geography and the Environment, University of Oxford, UK

Analysis of climate risks to infrastructure at national and global scales

Recently available global datasets and increasing computational capabilities are providing the possibility to analyse infrastructure networks and systems at very large scales. This is motivated by the need to understand the potential systemic risks from climatic extremes, which can cause wide-spread disruption to infrastructure networks, and to prioritise plans and investments to adapt infras-



tructure systems to a changing climate. This talk will provide an overview of the methodologies adopted for climate risk analysis to infrastructure systems and will describe recent large-scale applications in Africa, the Caribbean and South-East Asia. It will sketch out the journey towards global-scale analysis of transport, energy, water and telecommunications networks.

BIOGRAPHY

Jim Hall FREng is a professor of Climate and Environmental Risks in the University of Oxford and Director of Research in the School of Geography and the Environment. Before joining the University of Oxford in 2011 to become Director of the University's Environmental Change Institute, Prof. Hall held academic positions in the Newcastle University and the University of Bristol. Professor Hall is internationally recognised for his research on risk analysis and decision making under uncertainty for water resource systems, flood and coastal risk management, infrastructure systems and adaptation to climate change. Professor Hall is a member of the Prime Minister's Council for Science and Technology and is a Commissioner of the National Infrastructure Commission. He is Vice President of the Institution of Civil Engineers and is Chair of the Science Advisory Committee of the International Institute for Applied Systems Analysis (IIASA). He was a member of the UK independent Committee on Climate Change Adaptation from 2009 to 2019.

Professor Hall's group in the University of Oxford is at the forefront of risk analysis of climatic extremes and their impacts on infrastructure networks and economic systems, from local to global scales. He led the development of the National Infrastructure Systems Model (NISMOD), which was used for the UK's first National Infrastructure Assessment and for analysis of the resilience of energy, transport, digital and water networks in Great Britain and around the world. His group developed the first national water resource systems simulation model for England and Wales. Professor Hall conceived of, and now chairs, the UK's Data and Analytics Facility for National Infrastructure (DAFNI). His systems analysis methods have been applied worldwide, including in Argentina, China, Curacao, Ghana, Jamaica, St Lucia, Tanzania and Vietnam. He has published four books, including, The Future of National Infrastructure: A System-of-Systems Approach, which was published by Cambridge University Press in 2016.

Amongst various distinctions, Prof. Hall was awarded the George Stephenson Medal from the Institution of Civil Engineers in 2001 and the Prince Sultan Bin Abdulaziz International Prize for Water in 2018. Professor Hall was a Contributing Author to the Nobel Prize-winning Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In 2010 Prof. Hall was elected as a Fellow of the Royal Academy of Engineering "for his contribution to the development of methods for flood risk analysis, which underpin approaches for flood risk management in the UK and internationally". He has published more than 200 articles in peer reviewed journals, which have been cited more than 25,000 times, and is editor of the journal Water Resources Research.

Prof. Mahmoud Reda Taha

Distinguished Professor & Chair Department of Civil, Construction & Environmental Engineering The University of New Mexico, USA

Emerging Technologies for Resilient Infrastructure

The last few decades observed a noticeable increase in natural and man-made hazards including climate change, scarce resources, and increased energy challenges and demands. In civil infrastructure, the frequent occurrence of disasters and the challenges associated with maintaining the performance of critical infrastructure is an issue of great concern to professional societies and policyma-



kers. Such challenges lead to the need for resilient communities that can adapt to these abrupt changes and maintain the long-term functionality of the infrastructure. Over the years, traditional construction materials and classical design philosophies have proven not to yield to resilient systems but rather optimal ones that are sensitive to and fail to survive abrupt changes. Advancements in materials science and robotics introduced additive manufacturing, widely known as 3D printing, to the construction industry. This development has created opportunities in construction that were not possible a decade ago. Using such emerging technologies (ETs) appears as a robust solution to promote resilience in infrastructure and help maintain their functionalities during and after disruptive events.

In this presentation, I will discuss research investigations carried out by my research group at the University of New Mexico on developing a new generation of polymer concrete and composites that is nanomodified and 3D-printable with superior mechanical performance. Three distinct categories of ETs with great potential for impacting infrastructure resilience will be identified, namely, smart materials, advanced construction technology, and advanced sensing technology. The impact of these technologies on various components of resilience, known as the 4Rs, will be presented. I will showcase recent advancements of select ETs and their roles in resilient infrastructure, including nanomodified pultruded rebar and composites, super ductile textile reinforced polymer concrete, 3D printable low carbon foot-print concrete, ductile fiber composites, and cognizant fiber reinforced polymer (FRP) composites with potential artificial intelligence components. Additionally, the role of hybrid testing of composite joints and viscoelastic dampers will be demonstrated as unique structural features that can help enhance the resilience of infrastructure on a larger scale. The presentation will conclude with a roadmap for the current state and field implementation of ETs in infrastructure highlighting future opportunities and challenges.

BIOGRAPHY

Dr. Mahmoud Reda Taha, PE, is a Distinguished Professor, Regents' Lecturer, and Chairman of the Department of Civil, Construction & Environmental Engineering at the University of New Mexico, USA where he has worked for the past 20 years. He was the founding director of the UNM Resilience Institute. He authored and co-authored more than 350 papers in refereed journals and conference proceedings; he has eleven issued US-Patents and has advised more than 50 students toward their MS and Ph.D. degrees. He is a Fellow of the American Concrete Institute, a Fellow of the American Society of Civil Engineers, Chairman of the ACI Committee on Nanotechnology, a Section Editor of ASCE Journal of Materials, and the new Chairman of the ASCE Infrastructure Resilience Division. He is a licensed professional engineer at the US and Canada and an entrepreneur. He received his BS (Honors) and MS in Structural Engineering from Ain Shams University, Egypt, and his Ph.D. from the University of Calgary, Canada.

Prof. Mark G. Stewart

Director of the Centre for Built Infrastructure Resilience, University of Technology Sydney, Australia

Chasing Ghosts: Terrorism Risks to infrastructure

A key motivation for much research on protective structures is terrorism or insurgency attacks as witnessed by the Oklahoma city bombing, 7/7 attacks in London and other bombings worldwide. Risk is the integration of threat, vulne-rability and consequences, but threat is often based on worse-case thinking about the capability of terrorists to successfully plan and execute large scale bombings. The presentation initially looks at the nature of the terrorist adversary by explo-



ring their capabilities and motivation, technical skills, and target selection. An improved understanding of the threat allows decision-makers to more effectively deploy resources to counter such threats, which includes appropriate design and assessment of civilian and military protective structures.

The presentation will then show how a probabilistic understanding of blast loads and structural resistance can be used to estimate reliability-based load factors and probability of blast damage. This allows risk reductions to be calculated for blast protective measures. A cost-benefit assessment is illustrated by considering the effectiveness of bollards to increase stand-off from a VBIED and hence reduce the risk of progressive collapse. The presentation will describe infrastructure resilience to terrorist attacks, and discuss the nature of resilience and its impact on society under these threats.

BIOGRAPHY

Mark G. Stewart is a Distinguished Professor of Civil Engineering, and Director of the Centre for Built Infrastructure Resilience at the University of Technology Sydney. He is the author of Probabilistic Risk Assessment of Engineering Systems; Terror, Security, and Money: Balancing the Risks, Benefits, and Costs of Homeland Security; Chasing Ghosts: The Policing of Terrorism; Are We Safe Enough? Measuring and Assessing Aviation Security; and edited books Climate Adaptation Engineering: Risks and Economics for Infrastructure Decision-making and Engineering for Extremes: Decision Making in an Uncertain World as well as more than 500 technical papers and reports. He has over 35 years of experience in probabilistic risk and vulnerability assessment of infrastructure and security systems that are subject to man-made and natural hazards. In the past two decades Professor Stewart has received continuous Australian Research Council support to develop probabilistic risk-modelling techniques for infrastructure subject to military and terrorist explosive blasts and cost-benefit assessments of counter-terrorism protective measures for critical infrastructure. Articles about his terrorism findings have been published in the New York Times, CNN, Financial Times, Wall Street Journal, The Guardian, and many other media outlets worldwide. He has brought engineering and scientific expertise into the public policy domain. Professor Stewart is the Editor-in-Chief of Structural Safety.

Prof. Hongwei Huang

Department of Geotechnical Engineering and International Joint Research Center for Resilient Infrastructure, Tongji University, Shanghai, China

Resilience of Assembled Shield Tunnel Linings: from Test to Modeling and Measures

Shield tunnel is extensively employed for underground infrastructures, such as metro tunnel systems. In the operation of such a complex critical infrastructure, the vulnerability and the recovery of the segmental linings subjected to unexpected disruptions are badly concerned by the engineers and owners. These two aspects compose the basic concept of system resilience, which is receiving



increasing attention these years. The notion of resilience has prompted the formulation of a new philosophy in the design and assessment of the metro network, against external shocks, such as natural and man-made disasters. However, the study on the system resilience for tunnels remains at the stage of conceptualization so far. In this presentation, the reason for the structural resilience in terms of the deformed shapes is revealed by the full-scaled loading test on the segmental joint. The assembly of different structural components might be the reason that enables the integrated lining ring to have the resilience ability to deform forward and backward from extreme loading and unloading scenarios. Based on these physical test results, a resilience model in terms of the deformational performance is put forward with the emphasis on the general response of the lining deformation. This could be regarded as the systematic responses of the multiple components of an integrated lining ring, which consists of several concrete segments connected by the joints with connecting bolts and seal gasket. One countermeasure, i.e., grouting on the soils at two sides of the tunnels, is then discussed with the emphasis on the deformational performance of the resilience. Based on a case study on the Shanghai shield tunnel, the grouting resulted in a 30% reduction in horizontal convergence. However, less than 5% of the grouted volume contributed to the horizontal movement of the tunnel cross sections. Later, tunnel longitudinal uneven settlement caused by ground or closer engineering disturbance can also be recovered by grouting. In addition to the deformational performance, the performance in terms of the bearing capacity is furtherly analyzed given the strength enhancement by steel plate reinforcement. The resilience of the strength of the tunnel lining in a similar philosophy from a component of joint to a system of integrated rings is discussed at the end of this lecture.

BIOGRAPHY

Prof. Hongwei Huang is the Distinguished Professor of Tongji University, China. He is mainly engaged in risk assessment, risk early warning, and risk control for Geo-structural systems, underground infrastructure safety and health monitoring and inspection, etc. Currently, he is the founding director of the international Joint Research Centre for Resilient Infrastructure of Tongji University. And also he has been the Founding Chair of Engineering Risk and Insurance Research Branch of China Civil Engineering Society since 2009. While serving as core members for international academic committees including GEOSNet, Geo-Institute on Risk Management of ASCE, TC304 of ISSMEGE, WG2 of ITA, etc., Prof. Huang is also the Associate editor of ASCE-ASME Journal of Risk and Uncertainty of Engineering System, Editorial Board Members of Tunneling and Underground Space Technology, and GeoRisk. There have been numerous scientific works granted by National "973" and "863" Projects, 14 projects of National Natural Science Fund of China, and 17 major scientific research projects led by him. And with more than 200 journal papers and more than 6 books published, over 10 keynotes in various prestigious international conferences delivered, Prof. Hongwei Huang has also chaired more than 5 international Conferences and further received 2 International Distinguished Service Awards.

Prof. Xiaobo Qu *Chair Professor of Intelligent Transportation, Tsinghua University, China*

From Transportation Engineering to Intelligent Transportation Systems: Evolution, Trends and Applications

In this talk, the speaker will revisit the revolution from traditional transportation engineering to intelligent transportation systems, which is triggered by rapid development of vehicular, tele-communications, data collection and processing technologies. Then three trends will be discussed: high-resolution big data (due to the paradigm change in data collection and processing), emerging mobility modes and their integration with existing systems (e.g. connected and automa-



ted vehicles, modular buses, flying cars, boring), and systems of multiple systems (e.g. interactions with electricity grid, tele-communications systems). These three trends will play important roles in the planning, design, operations and control of our next generation transportation systems. A series of applications of these three trends will be introduced, and their benefit in relieving congestion reduction will be presented. This revolution needs collective multi-disciplinary efforts from transport engineering, vehicle engineering, industrial engineering and operations research, electrical engineering, social science as well as other relevant sectors.

BIOGRAPHY

Xiaobo is now with the School of Vehicle and Mobility, Tsinghua University, as a Changjiang Chair Professor of intelligent transportation systems. His research is focused on large, complex and interrelated urban mobility systems in the era of emerging vehicular and communication technologies. More specifically, his research has been applied to ground-air cooperation, the improvement of emergency services, operations of electric vehicles and connected automated vehicles, and management of vulnerable road users. He has authored or co-authored over 130 journal articles published at top tier journals, many of which appear in journals with broader impact than his own research community. He is a recipient of many prestigious awards, including the Ministry of Transport Minister's Innovation Award, Australian Department of Education Endeavor Cheung Kong Fellowship, etc. His research has been supported by Australian Research Council Discovery Programme, Swedish Innovation Agency Vinnova, STINT, and the European Union. In recognition of his academic standing, he was invited to serve as an assessor or panel member for many prestigious schemes, including ERC, Dutch NWO VICI program, HK RGC Theme Based Grant and GRF funds, Australian ARC Centre of Excellence, Future Fellowship, Singapore Ministry of Education Thematic Programme, etc. He is an elected Member of Academia Europaea - the Academy of Europe.

Dr. Mohammad Pourgol-Mohammad

Associate professor (Adj.), Mechanical Engineering Department, University of Maryland, USA

Approaches and Trends in Reliability Qualification Techniques in Semiconductor Industry

Electronics dominated complex engineering systems consists of interconnected and diverse hardware, and software in dynamic conditions, physical processes, and environments. There are vast advancements in the semiconductor industries like 5G, and 3-Nano technologies, requiring thorough reliability and



life evaluation at the various levels of wafers, components, and system. Specific Electronics features and challenges are unique failure mechanisms, high density of populated components, and high sensitivity to high frequency ranges, noises as well as environments variations. There are significant advancements and still immense challenges in electronics systems (alone or in conjunction with Electromechanical entities) reliability evaluation. This presentation will overview the analytical, simulation-based, and experimental advancements in electronics industry reliability analysis. The tools and approaches will be explained, and the trends will be discussed. This will include the classical FMEA, HALT/HASS testing, part stress and parts counts. Recent approaches are based on physics of failure, prognostics health management (PHM), and dynamic reliability evaluation.

Significant advances in sensing and computing have led to an explosion of system health data and development of PHM algorithms designed to monitor component reliability. This speech will discuss an integrated sensory measurement-based health prognostic and degradation prediction system consisting of a method for measuring, gathering, and processing environmental and operation information and collating it into useful health metrics that are available for monitoring remotely through standardized data aggregation systems. The focus will be here to estimate the fatigue, corrosion, wear and creep remaining useful life (RUL) of structures, Systems and Components (SSCs). The PoF models are represented through mathematical or deep learning, that predict degradation and likelihood of failure of SSCs using offline and sensor-based online vibration data along the working and environmental condition data and information (USPatented). Several Case studies will be presented.

BIOGRAPHY

Dr. Mohammad Pourgol-Mohammad is a safety/reliability analyst in multidisciplinary systems analysis and Associate Professor (adj) of Mechanical engineering at University of Maryland and an Associate Professor of Reliability Engineering, with Sahand University of Technology (SUT). He received his Ph.D in Reliability Engineering from University of Maryland (UMD), and holds one M.Sc degree in Nuclear Engineering and another in Reliability Engineering from UMD. His undergraduate degree was in Electrical Engineering. Dr Pourgol-Mohammad has more than 20 years of work experience including research and teaching in safety applications and reliability engineering at various institutions including Teradyne Semiconductor, Keurig Green Mountain, Johnson Controls, SUT, FM Global, Goodman Manufacturing, UMD, Massachusetts Institute of Technology (MIT), University of Zagreb-Croatia. He is a senior member of ASQ, ASME Fellow (was ASME Safety Engineering and Risk/Reliability Analysis Division (SER2D) Chair), ANS and member of several technical committees and a registered Professional Engineer (PE) in Nuclear Engineering in States of Massachusetts. He is a certified reliability engineer (ASQ CRE), certified six sigma Black Belt (CSSBB) and Manager of Quality/Organization Excellence (ASQ CMQ/ OE). He has authored more than 150 papers and reports on his researches and filed one US patent. His efforts have been recognized with several awards.

General Information

Registration Desk and Conference Office

Monday 5th September - Wednesday 7th September, 2022, 8:00 - 18:00

The registration desk and conference office will be located on the 14th floor of Building 1502. This building is directly connected to the main conference building. The way to the catering will be clearly signposted. See page 44 for directional maps.

Venue

Königsworther Platz 1 30167 Hannover

The conference building (Building 1501) is located at the Conti-Campus of the Leibniz Universität Hannover. The conference will mainly take place on the third and fourth floor of said building. A detailed depiction of the location of the main entrance can be found at the end of this booklet on page 44.

Directions

By train

After arrival at the central station of Hannover (Hannover Hauptbahnhof) cabs are available at both exits of the building. For further public transport, we strongly recommend the usage of the Hannover tram system (Üstra).

Even though the train station is also acting as a tram station, the most convenient access to the tram system is the Kröpcke hub station 200 metres south of the main station. After exiting the main station in the southern direction (following the City signs) simply walk straight along the subterranean shopping lane until you reach the Kröpcke station. Inside the station follow the guidelines to lines 4 (Garbsen) or 5 (Stöcken). Ride these tram lines for two stops until you reach the Königsworther Platz station. Once you exited the underground tram station, you can use the map printed at the end of this booklet to locate the main entrance of the conference building.

Tram lines 4 and 5 are the only direct stops at Königsworther Platz, so in any case (e.g. if you want to reach the conference from your hotel) it is reasonable to change to these lines at the central hub stations Kröpcke or Aegidientorplatz, as virtually all lines intersect at these two stations.

By plane

The closest airport is Hannover Airport, located roughly 10 kilometers from the conference venue. You will enter the main halls of the airport after arrival at Hannover and clearing all customs procedures. Follow the signs for the train station, which is located directly below terminal C. Between 04:36 and 23:36 the shuttle train S5 is departing every 60 minutes towards Hanover main station (Hauptbahnhof). The ride will take approximately 20 minutes. Once you arrive at the main station, simply follow the instructions given above.

By car

Hannover is connected fairly well to the highway system of Germany. Depending on the direction you arrive from, the route to the conference venue may vary for each traveler. Once you reached the destination, there is usually very limited parking space directly on the spot. During the first day (Sunday) it is very possible to get access to a parking spot directly in front of the university's main building. This might not be the case during weekdays. If you do not want to use public transportation during the conference, please contact someone of the conference team to ask where parking spots are available.

Guidelines for Presenters and Session Chairs

Each presentation has been allocated 15 minutes, with an additional 5 minutes for discussion. Please, keep to the scheduled times so that the conference can run smoothly and participants can attend the talks they wish to see.

Session chairs have been asked to keep exactly to the timetable. Presenters should upload their presentation onto the presentation computers before their session using a USB memory device.

These computers are running the Windows operating system. Please, keep in mind to bring your presentation files as either PowerPoint or PDF.

Presenters on site are not allowed to use their own computers as the conference computers are running the software for the online meeting. Changing computers will result in online participants not being able to follow the presentation and also takes time and valuable discussion away from the other presenters. Presenters should test their presentation out before beginning their session. Conference staff will be there during the breaks to help.

Presenters should meet the Session Chair during the break before the session. They are encouraged to provide very short written biographical statements to the Session Chair in advance.

Presenters and session chairs will be provided with a microphone for online meetings for the duration of the presentation or session. You will receive a technical briefing from the conference staff before the session and return the microphone to them after the presentation/session.

Session Chairs have the responsibility to introduce the speakers, to lead the discussions, and to ensure that the session schedule is observed. Every effort should be made to keep to the 20-minute total time allocation for each presenter to ensure the next talk starts on time. If a session presenter does not show up, the Session Chair should compensate, as much as possible, by allowing for appropriately extended discussion of the presented papers while maintaining the presentation sequence, and ensuring that the next speaker starts at the publicised time.

Certificate of Attendance

If you would like to receive a printed certificate of attendance you can request one at the registration desk.

Language

The official language of ISRERM 2022 is English.

Catering

The catering will be located at the 14th floor of Building 1502. This building is directly connected to the main conference building. The way to the catering will be clearly signposted.

Security

Your name badge must be worn at all times otherwise you will not be allowed entry to the main conference sessions.

Website

Please find more information like the authors area at the conference website. www.isrerm.org



Wi-Fi

SSID: UHEvent Password: E4fJL9Yc



First Aid

Should you require any assistance, please contact a member of the Conference Team located at the registration desk.



Special Sessions & Workshops

Award Session

Tuesday 6th September, 2022, 18:30 Room 1403

ISRERM is a multi-disciplinary forum for the exchange of knowledge and expertise on theories and methods of Reliability Engineering and Risk Management, for application to a wide range of problems. It is a platform, to discuss both academic and industrial, current and future challenges of sustainable development across various engineering disciplines, such as civil, mechanical, energy, aerospace and aeronautics, offshore and marine, and others. It offers the opportunity to showcase solutions to these challenges.

As the World sustainability challenges are evolving at a very fast pace, the solutions can only come from the involvement of mature expert practitioners and young enthusiastic researchers. These latter are quite fundamental and there must be the commitment to breed them into the problem-solving experts of the future. To this aim, ISRERM 2022 honors the contribution to the Conference of young participants involved in studies of Reliability Engineering and Risk Management, by awarding the best paper awards in a dedicated session. An expert committee has been established for this, which has received 13 submissions by students from Universities all over the World. The scientific level and technical quality of the works received are simply stunning, and all contributing students are definitely winners.

Yet, the committee was charged with the difficult task of shortlisting 5 of these works and rank them. The result is...come to hear it at the dedicated session!

RESET Workshop

Tuesday, 6th September, 2022, 10:50-12:10, Room 342 Wednesday, 7th September, 2022, 10:50-12:10, Room 342

The MSCA-RISE-2016 project RESET (May 2017 to Feb 2023) aims to develop and apply knowledge in Reliability and Safety Engineering and Technology (RESET), for safe and reliable design and operation of large maritime (marine and offshore) and other made-to-order (MTO) engineering systems. This project is multi-disciplinary and inter-disciplinary of the duration of 70 months and has created a consortium of complementary expertise targeting areas of academic and industrial importance.

In the context of this project, a workshop on reliability assessment for large maritime engineering systems will be organised in parallel with the ISRERM conference. Researchers and practitioners in safety and reliability from outside RESET institutions are welcome to participate in the workshop.



Icebreaker and Welcome Reception

Sunday 4th September, 2022, 18:00 - 21:00

The Icebreaker and Welcome Reception will take place in the room 1403, building 1502 level 14. See page 44 for maps.

Conference Dinner

Tuesday 6th September, 2022, 18:30

The Conference Dinner will take place in the in the room 1403, building 1502 level 14. See page 44 for maps.

Tour: Great Gardens and Glittering Grotto

Monday 5th September, 2022, 18:00

Meeting point: Conference Office, 17:15 or Infopavillion of the Great Garden, 17:50



Accompany us on this very special tour and experience the extraordinary beauty of the baroque Great Gardens. The tour features the magnificent water displays, sculptures, the garden theatre and Niki de Saint Phalle's magical grotto.

Tour: City Hectic and History

Wednesday 7th September, 2022, 18:00

Meeting point: Conference Office, 17:15 or Ernst August Monument at the main railway station, 17:50

Take a trip through time on a walk through the downtown area and a thousand years of Hannoverian history. From humble beginnings, through royal glory, destruction and rebirth to the most recent developments on the evolution of the modern city.



Opening & Closing Sessions

Opening

Monday 5th September, 2022, 8:30 - 9:30, Room 401

Agenda:

Welcoming the participants and moderating the session *Michael Beer*

Welcome address on behalf of the ISRERM board of directors and the Asian community *Kok-Kwang Phoon*

Welcome address on behalf of Leibniz University Hannover *Christina von Haaren*

Welcome address on behalf of ESRA *Enrico Zio*

Welcome address on behalf of ASME SERAD Mohammad Pourgol-Mohamad

Welcome address on behalf of ASCE IRD *Mahmoud Reda Taha*

Closing

Wednesday 7th September, 2022, 17:00 - 17:40, Room 401

Agenda:

Closing address and moderating the session *Michael Beer*

Closing address *Bilal M. Ayyub*

Announcement of the next ISRERM held in Hefei *Jingfeng Wang*

Program Summary

	5/9 Monday		6/9 Tuesday	7/9 Wednesday	
8:30- 9:30	Opening Room: 401	8:30- 9:10	Keynote 3 Mark G. Stewart Chair: Matthias Faes Room: 401	Keynote 5 Xiaobo Qu Chair: Michael Beer Room: 401	
9:30- 10:30	Ang Lecture		moving	moving	
	Room: 401	9:20- 10:20	Densellal Sanciana	Devellet Services	
10:30- 11:00	Break			Faraller Sessions	
11:00- 11:40	Keynote 1	10:20- 10:50	Break	Break	
	Chair: Mohammad Pourgol- Mohammad Room: 401	10:50- 12:10	Parallel Sessions	Parallel Sessions	
11:40- 12:20	Keynote 2				
	Mahmoud Reda Taha Chair: Enrico Zio Room: 401	12:10- 13:40			
12:20- 13:50			Lunch	Lunch	
12:50	Lonch	13:40- 14:20	Keynote 4 Hongwei Huang Chair: Edoardo Patelli	Keynote 6 Mohammad Pourgol- Mohammad	
15:30			Room: 401	Room: 401	
	Parallel Sessions	14.20	moving	moving	
		14:30 15:30	Parallel Sessions	Parallel Sessions	
15:30- 16:00	Break	15:30- 16:00	Break	Break	
16:00- 17:40	Parallel Sessions	16:00- 17:40	Parallel Sossions	Parallel Sessions	
	Parallel Sessions			Closing Room: 401	

P



5 Sept **Monday**, 13:50-15:30, 4 Parallel Sessions, 5 Papers per Session

Session	GS 03	GS 01	MS 15	MS 14
Room	Room 442	Room 401	Room 301	Room 332
Chair(s)	Ekaterina Auer	Matteo Broggi	Mathias Faes	Suk Joo Bae
13:50-	Xiaolei Li	Zhenhao Zhang	Yichuan Li	Munwon Lim
14:10	Probability distribution of vib- ration isolation area in phonon crystal arrays with finite length	The fatigue cumulative damage and reliability analysis of sub- way bogie structure based on the duration of stochastic pro- cess exceeding threshold	Effect of vertical seismic on dynamic reliability analysis of 2D slopes considering the spatial variability of soil para- meters	Spatio-temporal Monitoring of Image Degradation for Manu- facturing Process
14:10-	Deepak Pant	Mohsen Rashki	Matthias Faes	Yide Zheng
14:30	A Practical Framework for Evaluating the Seismic Resi- lience of Ports	The proposed rank-based active learning Kriging for ef- ficient structural reliability ana- lysis using weighted average simulation method	Bounding Failure Probabilities in Imprecise Stochastic FE models	A new method on system reliability analysis based on survival signature theory
14:30-	Ekaterina Auer Mariusz Maslak		Victor Krymsky	Massimiliano Giorgio
14:50	Dempster-Shafer Theory Based Uncertainty Models for Asses- sing Hereditary, BRCA1/2-Re- lated Cancer Risk	Fire Resistance of Simple Steel Beam – Probability-Based Ap- proach to Evaluation	Interval-Valued Probabilities: Reasons and Benefits of Ap- plication to Human Cognitive Reliability Model	Remaining useful life estima- tion of units characterized by a bathtub-shaped degradation rate in the presence of random effect
14:50-	Eric Ford	MS 04	Marcos Valdebenito	Ashraf Alghanmi
15:10		Yauhen Varabei		
	Oil spill preparedness: Model- ling challenges and implicati- ons for decision-making	Machine Learning Techniques for Intelligent Life Cycle Ma- nagement	Estimation of Second-order Statistics of Buckling Loads Applying Linear and Nonlinear Analysis	Understanding the Impact of the Operational Fault on Buil- ding Energy Performance
15:10-	Yukihiro Takahashi	Fabian Kaufmann D	Jinxing Liu	GS 05
13.30				Jan Grashorn
	Approximation Representation of Observed Strong Ground Motion Distribution using Mode Synthesis of Predicted Distributions	Drone-based acquisition of as- built models for the automation of processes within the digital management of bridge assets	Random-interval hybrid re- liability analysis by a parallel active learning Kriging method with a pseudo weighted expec- ted risk function	The Log-Rayleigh Distribution for Local Maxima of spectrally represented Log-normal Pro- cesses



5 Sept **Monday**, 16:00-17:40, 4 Parallel Sessions, 5 Papers per Session

Session	GS 03	MS 04	MS 10	
Room	Room 442	Room 401	Room 301	Room 332
Chair(s)		Katharina Klemt-Albert	Edoardo Patelli	
16:00-	Veli-Pekka Salo	Johannes Wimmer	Xinyu Jia	
16:20	Achieving visibility and effi- ciency in reliability manage- ment by integrating RAM ana- lysis with modern IoT platform	Obtaining data from concrete structures	Hierarchical Bayesian Lear- ning for Structural Damage Identification	
16:20- 16:40	Jaskanwal Chhabra 🖂	Matthias Müller	MS 16	
10.40			Xujia Zhu 🖂	
	A Framework for Airport Func- tional Downtime Estimation due to Structural Impacts under Natural Hazards	Formulation and Comparison of Maintenance Strategies using BIM-based Life Cycle Analyses	Use of generalized lambda models for seismic fragility analysis	
		\frown		
16:40- 17:00	MS 08	Hendrik Schäbe [▷K]	Bruno Sudret	
16:40- 17:00	MS 08 Dongkyu Lee	Hendrik Schäbe [▷ʃ]	Bruno Sudret	Best Paper Award Committee Meeting
16:40- 17:00	MS 08 Dongkyu Lee Maintenance Decision-making for Infrastructure Systems Using Clustering-based Co- operative Multi-Agent Deep Q-Network	Hendrik Schäbe	Bruno Sudret Active learning for system reliability analysis using PC- Kriging, subset simulation and sensitivity analysis	Best Paper Award Committee Meeting
16:40- 17:00	MS 08 Dongkyu Lee Maintenance Decision-making for Infrastructure Systems Using Clustering-based Co- operative Multi-Agent Deep Q-Network Conal Brown	Hendrik Schäbe <pre></pre>	Bruno Sudret Active learning for system reliability analysis using PC- Kriging, subset simulation and sensitivity analysis Youngjun Kwon	Best Paper Award Committee Meeting
16:40- 17:00 17:00- 17:20	MS 08 Dongkyu Lee Maintenance Decision-making for Infrastructure Systems Using Clustering-based Co- operative Multi-Agent Deep Q-Network Conal Brown Analysis of inspection records to evaluate the prevalence of ageing in the UK's industrial asset base	Hendrik Schäbe > Computing characteristics for the availability of paths and its application to a communication network > Lukas Eichner A framework for data and structural integrity management for support structures in offshore wind farms based on building information modelling	Bruno Sudret Active learning for system reliability analysis using PC- Kriging, subset simulation and sensitivity analysis Youngjun Kwon Evaluation of Relative Import- ance of Network Components by System-reliability-based Disaster Resilience Analysis	Best Paper Award Committee Meeting
16:40- 17:00 17:00- 17:20 17:20-	MS 08 Dongkyu Lee Maintenance Decision-making for Infrastructure Systems Using Clustering-based Co- operative Multi-Agent Deep Q-Network Conal Brown Analysis of inspection records to evaluate the prevalence of ageing in the UK's industrial asset base	Hendrik Schäbe <pre></pre>	Bruno Sudret Active learning for system reliability analysis using PC- Kriging, subset simulation and sensitivity analysis Youngjun Kwon Evaluation of Relative Import- ance of Network Components by System-reliability-based Disaster Resilience Analysis Julian Salomon	Best Paper Award Committee Meeting

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Session	MS 13	MS 20	MS 01	MS 11	MS 07
Room	Room 442	Room 332	Room 401	Room 301	Room 342
Chair(s)	Timo Schweckendiek	Umberto Alibrandi	Michael Beer	Takeshi Kitahara	
9:20- 9:40	Yukihisa Tomizawa	Guangli Du	Meng-Ze Lyu	Hiroki Ishibashi	Nikolaos P. Ventikos
	Study on autocorrelation model for spatial distri- bution of soil properties using Gaussian process regression	Utility of Information (UoI) for probabilistic fatigue monitoring	Time-variant reliability analysis for high-dimen- sional nonlinear sys- tems under non-white excitation based on the globally-evolving-based generalized density evo- lution equation	Resilience assessment of road network subjected to ground motion and tsunami caused by the earthquake along the Japan Trench	MOSES Autonomous tugboat swarm opera- tion: Operational scena- rios, requirements, and architecture
9:40- 10:00	Tomoka Nakamura	Yuan Feng	Rongyue Zhu	Di Lin	Nikolaos P. Ventikos
	Observation update of model parameters and	Safety assessment of di-	Survival Probability of	Synthesis of Design	A systems ongineering
	limit state probabilities of consolidation settle- ment prediction using data assimilation	gital twin structures un- der low-velocity impact	Nonlinear Oscillators Subject to Combined Periodic and Stochastic Excitation	Ground Motion for Nonlinear Analysis with Features Identified from Records Satisfying Spe- cified Condition	framework for the safety analysis of MASS
10:00-	limit state probabilities of consolidation settle- ment prediction using data assimilation	gital twin structures un- der low-velocity impact Matthew Bonney	Nonlinear Oscillators Subject to Combined Periodic and Stochastic Excitation Peihua Ni	Ground Motion for Nonlinear Analysis with Features Identified from Records Satisfying Spe- cified Condition	Tengfei Wang

6 Sept **Tuesday**, 9:20-10:20, 5 Parallel Sessions, 3 Papers per Session

C : Online

	5 Parallel Sessions	, 4 Papers per Sessi	on		
Session	MS 13	MS 05	MS 01	MS 11	RESET Workshop
Room	Room 442	Room 332	Room 401	Room 301	Room 342
Chair(s) 10:50- 11:10	Jianye Ching Takayuki Shuku (D) 3D data-driven site characterization using geotechnical lasso with basis functions	Xuan-Yi Zhang Chao-Huang Cai () Time-Dependent Re- liability Assessment Method for Horizontal Eleveral Steargth of the	Michael Beer Marco Behrendt Stochastic process ge- neration from relaxed power spectra utilising stochastic harmonia	Masaru Kitahara Taro Yaoyama D Multi-scale and Mul- ti-performance Urban Monitoring Based on Data driven Techniques	
	basis functions	CRTS II Track Slab	functions	Data-driven reeninques	
11:10- 11:30	Xin Liu D Quantitative risk as- sessment of rainfall-in- duced landslides using random finite element and material point methods (RFE-MPM) with hydro-mechanical coupling	Yutao Lu DA Updating the Reliability of Degrading Structures Based on the Method of Moments	Georgios Pasparakis Stochastic response ana- lysis of a piezoelectric harvesting device sub- jected to non-stationary wind loading	Takashi MiyamotoIntegrating PredictionPhysical MethodsAnd AI-basedSatelliteData AnalysisMethodsin EarthquakeDamageEstimationKethods	Reliability and Safety Engineering and Technology Workshop
11:30-	Alexandra Ene	Pei-Pei Li	Karl Breitung	Marco Behrendt	Chair: Jin Wang
11:50	Full probabilistic ana- lysis with fem for the retaining wall of a deep excavation	An effective method for load and resistance factor design based on third-moment transfor- mation	Failure Probability Esti- mation, a Short History: Concepts and Miscon- ceptions	Classification of power spectra from data sets with high spectral variance for reliability analysis of dynamic structures	
11:50-	Antonis Mavritsakis	Jun Wang	Jungho Kim		
	Hierarchical Bayesian modelling for geotechni- cal parameter derivation	Interface debonding re- liability of CRTS II track slab - CA mortar	Active learning frame- work for estimating first-passage probability of stochastic wind-ex- cited structural systems		

6 Sept **Tuesday**, 10:50-12:10, 5 Parallel Sessions, 4 Papers per Session

6 Sept **Tuesday**, 14:30-15:30, 4 Parallel Sessions, 3 Papers per Session

Session	MS 13	MS 05	MS 06	MS 17
Room	Room 442	Room 332	Room 401	Room 301
Chair(s)	Marcin Chwała	Zhao-Hui Lu	Sifeng Bi	Ahmed Karar
14:30-	Shin-Ichi Nishimura 🖂	Ye-Yao Weng	Pengfei Wei	
14:50	Application of Response Surfa- ces Method for Risk Evaluation of Earth-fill Dams	Novel approach for structural reliability assessment based on generalized characteristic function estimation	Physic-informed probabilistic analysis with Bayesian machi- ne learning in augmented space	
14:50-	Marcin Chwała	Xiang-Wei Li		Aisha Sa'ad
15:10	Random Failure Mechanism Method in Optimal Borehole Placement for Shallow Foun- dation Design Under Spatially Variable Conditions	Time-variant Reliability of Crack Width Failure Mode of CRTS II Foundation Plate on Bridge		Reliability Assessment and Op- timal Maintenance Scheduling of a Photovoltaic System: A Nigerian Case Study
15:10- 15:30	Daniel Teshager	Tian-Feng Wang	Chao Dang	Ahmed Noaman Karar
	Probabilistic foundation settle- ment using a hardening soil model on layered and spatially variable soil	Extreme value estimation of wind effect based on Pearson system transformation process	Estimation of response expec- tation function under hybrid uncertainties by parallel Baye- sian quadrature optimization	A Resilience-based Asset Ma- nagement Strategy Approach Using Analytical Hierarchy Process



6 Sept **Tuesday**, 16:00-17:40, 4 Parallel Sessions, 5 Papers per Session

Session	MS 13	MS 20	MS 06	MS 17	
Room	Room 442	Room 332	Room 401	Room 301	
Chair(s)	Enrico Zio	Hector Jensen	Sifeng Bi	Ahmed Karar	
16:00-	Johan Spross	Umberto Alibrandi 🖂	Yu Chen	Qingyao Qiao	
16:20	Optimization of LCC for soil improvement using Bayesian statistical decision theory	Quantum-like Uncertainty Quantification (QUQ) for urban sustainability and resilience	Uncertainty quantification over spectral estimation of stochas- tic processes subject to gapped missing data using Variational Bayesian inference	Preliminary exploration of re- cursive feature elimination and empirical decomposition for building energy consumption prediction	
16:20-	Yuxiang Ren	Wolfram Luther	Alice Cicirello	Akilu Yunusa-Kaltungo D	
16:40	Using the ensemble data assi- milation for stiffness evalua- tion of an embankment	Feature-oriented Digital Twins for Life Cycle Phases Using the Example of Reliable Museum Analytics	Propagation of Imprecise Pro- bability descriptions via machi- ne learning based optimization for robust reliability analysis	Development of a Framework for Implementing Asset Regis- ter Solutions	
16:40-	Timo Schweckendiek	Jamshid Mohammadi D	MS 18	Akilu Yunusa-Kaltungo D	
17:00			Chengxin Feng	•	
	Reliability assessment of quay walls using adaptive meta-mo- delling	Sourcing Uncertainty Data by Perception, Experience and Opinion – Methods and Procedures, Advantages and Challenges	Reliability Analysis of Lands- lides Based on the Random Finite Element Method	An analysis of the practicality of implementing asset manage- ment systems in the context of a complex cultural environment	
17:00- 17:20		MS 12	Abigail Beck	GS 06	
17.20		John Thedy		Nicola Esposito	
		Reliability of Multi Story CLT Shear Wall Structure Conside- ring Connection Uncertainty	Comparative retrofit prioritiza- tion schemes for electric power networks: Application to the community in Seaside, OR	Impact on performances of a condition-based maintenance policy of misspecification of gamma with inverse Gaussian degradation process	
17:20- 17:40		Marc Fina	MS 28	Alicia Ruvinsky	
17.40			Omar Nofal		
		Optimal shell design with poly- morphic uncertain parameters	Interdependent Households- Buildings-Networks Com- munity-Level Post-Hazard Functionality Assessment Methodology	An Ontology for an Epigene- tics Approach to Prognostics and Health Management	

	5 Parallel Sessions	, 3 Papers per Sessi	on		
Session	MS 09	MS 21	MS 01	MS 18	MS 07
Room	Room 301	Room 442	Room 401	Room 332	Room 342
Chair(s)	Yasutoshi Nomura	Bin Huang	Michael Beer	You Dong	
9:20- 9:40	Fang-Wen Ge	Heng Zhang	Zixin Liu	Ghazanfar Ali Anwar	Zhenshiyi Tian 🖂
	On the Distribution of Structural Demand in Fragility Analysis	Homotopy stochastic residual error method for structural elastic stability analysis	Dynamic response and reliability analysis of long-span high-pier rigid bridge subjected to multi-support and mul- ti-component ground motion	Gaussian process-based optimization framework for community building portfolios considering resilience and sustaina- bility objectives	Economic losses assess- ment of China's ports disruption under ty- phoon-induced extreme wind
9:40- 10:00	Yasutoshi Nomura	Jun Hes	Chen Ding	Tao Wang	Zhihong Li
	Structural Identification Based on Merging Par- ticle Filter for Earthqua- ke Response	A Sparse Grid Stochas- tic Collocation Method for Structural Reliability Analysis	First-passage probability estimation of stochastic dynamic systems by a parametric approach	Functionality-oriented seismic performance assessment of Internet data centers	Risk and Reliability Analysis for MASS: A Bibliometric Review of Literature from 2015 to 2021
10:00-	Tadanobu Sato 🖂	Yejun LI 🖂	Renjie Han	Cao Wang 🔊	Zaili Yang 🛛 🖸
10:20	Simulation of Design Response Compatible Acceleration Time Histories Considering the Fourier Phase Un- certainty and Their Ap- plication for Dynamic Analysis of Structure System	A new method for the re- sponse of a random plate	An approximate approach for fractional nonlinear system response determination under combined periodic and non-stationary stochastic excitation	An explicit approach to estimating cumulative tropical cyclone damage	AIS data-based machine learning for unsupervi- sed route planning of Maritime Autonomous Surface Ships

7 Sept **Wednesday**, 9:20-10:20, 5 Parallel Sessions, 3 Papers per Sess

C : Online

	5 Parallel Sessions	, 4 Papers per Sessi	on		
Session	MS 09	MS 21	MS 23	MS 19	RESET Workshop
Room	Room 301	Room 442	Room 401	Room 332	Room 342
Chair(s)	Yan-Gang Zhao	Heng Zhang	Enrico Zio	Matteo Broggi	
10:50-	Yan-Gang Zhao 🖂	Zhifeng Wu	Rafał Bredow	Chulyoung Kang 🖂	
11:10	Seismic Resilience Assessment of Steel Frames	A new homotopy ap- proach for stochastic static model updating with large uncertain measurement errors	Dynamic analysis of steel hall exhibiting some mechanical uncer- tainties	Regression-based Esti- mation of Uncertainties in Engineering Demand Parameters of Building Structures for Regional Seismic Loss Assess- ment	
11:10-	Hiroshi Matsuzaki 🖂	Hui Chen 🖂	Bin Han 🖂	Chengwei Zhai 🖂	
11:30	Effect of Column Height on the Reliability of Seismically Isolated Bridges	A new stochastic model updating method based on improved cross-mo- del cross-mode techni- que	Modeling the Sys- tem-Level Reliability towards a Convergence of Communication, Computing and Control	Multi-hazard power re- silience modeling using synthetically generated distribution networks	Reliability and Safety Engineering and Technology Workshop
11:30- 11:50	Saki Yotsui		MS 23	Yuankang Sun 🕅	Chair: Jin Wang
			Beatrice Cassottana		
	Evaluation of the effect of bearing deterioration on the seismic hazard of the bridge		Development and appli- cation of a cyber-phy- sical system resilience assessment framework	Simulation and risk evaluation of possible superstorms hitting Eu- rope's north sea coast	
11:50-	Takeshi Kitahara		Fabrizio Baiardi	Michiyo Sugai [🖂	
12:10	Model parameter upda- ting of seismic-Isolated bridge pier using modi- fied TMCMC		Defending from Supply Chain Attacks	Practical Method for Estimating Accelera- tion Fourier Amplitude Spectrum at an Arbitrary Point	

7 Sept **Wednesday**, 10:50-12:10, 5 Parallel Sessions, 4 Papers per Sessio

	3 Parallel Sessions, 3 Po	apers per Session	
Session	MS 09	MS 02	MS 23
Room	Room 301	Room 442	Room 401
Chair(s)	Takeshi Kitahara	Matteo Broggi	Marcos Valdebenito
14:30-	Sangwon Lee	Miriam B. Dodt	
14:50	From "Structural Health Mo- nitoring" to "Building Health Care" - Opportunities and Challenges -	Comparison of state of the art sampling-based Bayesian Up- dating techniques	
14:50-	Guan Chen	Adolphus Lye	MS 12
15:10			Catharina Czech
	Frequency comparison of the pulse-like and non-pulse ground motions	On-line Bayesian Model Up- dating and Model Selection of a Piece-wise model for the Creep-growth rate prediction of a Nuclear component	Robust multi-fidelity optimiza- tion approach exploiting data- driven, non-linear model order reduction
15:10-	Masaru Kitahara	GS 07	Hui Li
15.50		David Anton	
	Assessing updated seismic per- formance of existing structures by stochastic model updating	Identification of Material Para- meters from Full-Field Displa- cement Data Using Physics-In- formed Neural Networks	Reliability sensitivity analysis and optimization design based on direct probability integral method

7 Sept **Wednesday**, 14:30-15:30, 3 Parallel Sessions, 3 Papers per Session

7 Sept **Wednesday**, 16:00-17:40, 1 Session, 3 Papers per Session

Session	MS 12
Room	Room 401
Chair(s)	Hector Jensen
16:00-	Marcos Valdebenito
16:20	Estimation of First Excursion Probability in Stochastic Li- near Dynamics by means of Multidomain Line Sampling
16:20- 16:40	Philipp Edler
	Adaptive surrogate modeling approach for structural optimi- zation under uncertainties
16:40- 17:00	Danko Jerez
	A Bayesian Framework for Multiobjective Optimization of Stochastic Dynamical Systems

Symposia and Sessions

Mini Symposia

S

MS 01	Computational Methods and Applications for Stochastic Engineering Dynamics			
	V. C. Fragkoulis, J. Xu, F. Kong, M. Beer, and I. A. Kougioumtzoglou			
MS 02	Data-driven inverse methods for uncertainty quantification			
	Matthias Faes, Sifeng Bi, Matteo Broggi, and Edoardo Patelli			
MS 03	Data-driven versus Synthetic Tools used in Hazard Impact Assessment of Built-Environment			
	Derya Deniz			
MS 04	Digital methods in the lifecycle of infrastructure systems to enhance reliability of operation			
	Robert Hartung, and Katharina Klemt-Albert			
MS 05	Life-cycle Reliability of High-Speed Railway Structural System			
	Xuan-Yi Zhang, Zhao-Hui Lu, Yan-Gang Zhao, and Chun-Qing Li			
MS 06	Machine Learning for Uncertainty Quantification and Structural Reliability			
	Pengfei Wei, Yongbo Peng, Sifeng Bi, and Yi Zhang			
MS 07	Maritime Safety and Smart Shipping			
	Xinping Yan, Di Zhang, Chengqing Yuan, Jin Wang, and Jialun Liu			
MS 08	Mini Symposium on Uncertainty-informed asset management			
	Agnieszka Tubis, Sylwia Werbińska-Wojciechowska, Dragan Komljenovic, Georges Abdul-Nour, François Gauthier, George Zsidisin, and Lech Bukowski			
MS 09	Model Identification and Structural Reliability Analysis with Complex and/or Combined Uncertainty for Structural Dynamic Problem under Seismic Excitation			
	Takeshi Kitahara, Yan-Gang Zhao, Siu-Kui Au, and Yasutoshi Nomura			
MS 10	Non-deterministic model updating and health monitoring with uncertainty treatment			
	Sifeng Bi, Lechang Yang, Pengfei Wei, Yi Zhang, and Yongtao Bai			
MS 11	Novel Data Science for Disaster Prevention and Resilience of Civil Infrastructures			
	Takeshi Kitahara, Yoshikazu Takahashi, Michael Beer, and Masaru Kitahara			
MS 12	Optimal Structural Design under Uncertainty			
	Héctor Jensen, Jianbing Chen, Marcos Valdebenito, and Dixiong Yang			
MS 13	Probabilistic approaches in geotechnical engineering			
	Timo Schweckendiek, and Jianye Ching			
MS 14	Reliability Analysis and Prognostics for Complex Systems			
	Suk Joo Bae			
MS 15	Reliability Analysis under Aleatoric and Epistemic Uncertainty			
	Matthias Faes, Jingwen Song, Pengfei Wei, Xiukai Yuan, and Marcos Valdebenito			
MS 16	Reliability and Resilience of Critical Infrastructure Systems and Networks			
	Michael Beer, Konstantin Zuev, Edoardo Patelli, Matteo Broggi, and Frank Coolen			
MS 17	Resilience and Reliability Modelling of Critical Assets in the Age of Disasters & Pandemics			
	Ashraf Labib, Dylan Jones, Akilu Kaltungo, and Ahmed Noaman Karar			

MS 18	Resilience Modeling for Risk-Informed Decision Support		
	John W. van de Lindt, and You Dong		
MS 19	Risk-based damage assessment and prediction of infrastructure systems subjected to natural hazards		
	Cao Wang, Hao Zhang, Yue Li, and You Dong		
MS 20	Risk-informed Digital Twins of Buildings, Bridges, Offshore structures:		
	frameworks, methods, and tools		
	Umberto Alibrandi, Alba Sofi, and Lars V. Andersen		
MS 21	Stochastic finite element methods and their applications on model updating		
	Bin Huang, Heng Zhang, and Hui Chen		
MS 22	Understanding of Risk for Sustainable Engineering		
	Monika Sester, Steffi Robak, Lysann Zander, Ingo Liefner, and Michael Beer		
MS 23	Reliability and Maintenance for Internet of Things and 5G+ Networks		
	Yan-Fu Li, Muxia Sun, and Enrico Zio		

Please find more information about the Mini Symposia at the conference website:

https://isrerm.org/2022/symposia-and-sessions



General Session Topics

GS 01	Structural Reliability
GS 03	Risk Assessment and Management
GS 05	Design under Uncertainty
GS 07	Health Monitoring and System Identification
GS 09	Economic and Financial Risk
GS 11	Asset Management
GS 13	Business Continuity

- **GS 02** System Reliability
- **GS 04** Resilience Engineering
- GS 06 Prognostics and Maintenance
- GS 08 Geotechnical and Environmental Risk
- **GS 10** Product Reliability
- GS 12 Decision Making under Uncertainty
- **GS 14** Other Topics



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- · Scenario development and rate quantification,
- Consequence assessment,
- · Valuations, perception, and communication,
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- · Resilience assessment and design for resilience,
- Uncertainty analysis and modeling,
- Other related areas.

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Leibniz Universität Hannover Institut für Risiko und Zuverlässigkeit Callinstraße 34 30167 Hannover Tel.: +49 511 762 5981 Fax: +49 511 762 4756 E-Mail: office@irz.uni-hannover.de

Typesetting and Layout

Torsten Ilsemann ilsemann@irz.uni-hannover.de Tel. +49 511 762 - 14987

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