QR2MSE 2024

The 14th International Conference on

Quality, Reliability, Risk, Maintenance, and Safety Engineering

July 24-27, 2024, Harbin, Heilongjiang, China

Sponsored by

- The Institution of Engineering and Technology
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- The Korean Reliability Society
- Reliability Division of the Korean Society of Mechanical Engineers
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QR2MSE 2024

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I. Welcome

On behalf of the Organizing Committee, it is our pleasure to welcome you to the 14th International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE2024). This esteemed conference will convene in Harbin, Heilongjiang, China, from July 24 to 27, 2024.

Over the past fourteen years, QR2MSE has established itself as a premier international platform for distinguished experts and engineers from various domains, including quality, reliability, risk, maintenance, and safety engineering, to present their innovative research and share advanced methods and tools. The conference has seen substantial growth through the robust support of our colleagues and peers, and has garnered a reputation as one of the foremost gatherings in the reliability community. We take pride in the notable advancements in the careers of numerous young researchers who have evolved alongside this conference.

This year's program features 312 rigorously selected papers from approximately 600 submissions, which are included in the conference proceedings. Our schedule includes 10 keynote lectures delivered by globally acclaimed scholars, 10 special sessions, and 15 regular sessions, offering rich opportunities for scholarly exchange and professional networking.

The success of QR2MSE2024 relies on the commitment of various individuals, including conference chairs, advisory and program committee members, organizers, and volunteers. We are deeply appreciative of the support from esteemed societies, institutions, and groups such as The Institution of Engineering and Technology, European Safety and Reliability Association, The Korean Reliability Society, Reliability Division of the Korean Society of Mechanical Engineers, IEEE Reliability Society Japan Joint Chapter, Reliability Engineering Association of Japan, Korean Society for Prognostics and Health Management, International Society of Engineering Asset Management, Bernoulli Society for Mathematical Statistics and Probability, Reliability Committee of Operations Research Society of China, Reliability Engineering Division of Chinese Mechanical Engineering Society, Reliability Engineering Division of Sichuan Mechanical Engineering Society, and Center for System Reliability and Safety at the University of Electronic Science and Technology of China. Additional supporters include Harbin Institute of Technology, University of Electronic Science and Technology of China, China University of Mining and Technology, GRG Metrology & Test Group Co., Ltd. Harbin University of Science and Technology, Hunan University of Science and Technology, Inner Mongolia University of Technology, Jiangxi University of Science and Technology, Qinda Technology Co., Ltd., and Chengdu Chuangpin Robot Research Center (Limited Partnership) Co., Ltd.

We are confident that QR2MSE2024 will exceed your expectations and provide a fulfilling experience. We eagerly anticipate your participation and hope you enjoy your time in Harbin. We also look forward to continuing our collaboration in future conferences.



Professor Guofu Zhai General Chairs of QR2MSE 2024

Director of Key Laboratory of Electronic Component Reliability, Ministry of Education

Harbin Institute of Technology



Professor Hong-Zhong Huang General Chairs of QR2MSE 2024

Director of Center for System Reliability and Safety

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IV. Keynote Speeches

A. Keynote Speech 1



Thursday, July 25 / 08:45-09:25, Grand Ballroom

Title: Maintenance and Warranty Policy for Repairable System Subject to Lemon Law Conditions

Dong Ho Park, PhD, Professor Founder and Honorary President of the Korean Reliability Society Fellow in the Korean Academy of Science and Technology

Abstract: The search for an optimal maintenance and warranty policy has been a hot issue for a long time in the field of reliability engineering and a number of research results have been proposed in the literature. This presentation focuses on the maintenance and warranty policy for a repairable system subject to the "lemon law" conditions and its recent related works. The lemon law is a regulation to protect the customers from the defectives when the system failures occur repeatedly or the accumulated repair time exceeds a certain limit and is widely enforced over most industrialized nations. In most situations, the period during which the lemon law is effective is shorter than the warranty period and is set different from region to region. Recent research works on various situations are reviewed and the case for mutual interaction of the system components are briefly discussed as well.

Speaker Bio: Dong Ho Park is a professor, emeritus at Hallym University, Chuncheon, Korea. He received his B.S. degree in Applied Mathematics from Seoul National University, Seoul, Korea and M.S. and Ph.D. degrees from Florida State University, Tallahassee, USA, in 1980 and 1982, respectively. He was formerly an associate professor at University of Nebraska-Lincoln, USA, until 1995 and was a director of Statistics Division, Department of Mathematics and Statistics during 1992-1993. He is a founder of the Korean Reliability Society in 1999 and assumed the presidency of that society from 1999 to 2004. In 2009, he received a prestigious presidential medal for his contribution in developing the Korean science and technology and in 2010, he was elected as a fellow in the Korean Academy of Science and Technology (KAST). He also was a recipient of a Gallup award from the Korean Statistical Association in 2012. Since his retirement in 2012, he has been working as a research professor at Industry Academic Cooperation Foundation in Hallym University, Korea. At present time, he is an honorary president of The Korean Reliability Society. He has published a large number of research papers in various areas of reliability theory, including nonparametric classes of life distributions and hypotheses life testing, Bayesian estimation, software reliability, and system warranty and maintenance policy, in a wide variety of international journals.



B. Keynote Speech 2



Thursday July 25 / 09:25-10:05, Grand Ballroom

Title: Maintenance and Design Optimization for Systems of Dependent Degrading Components

David Coit, PhD, Professor Rutgers University, Piscataway, NJ, USA

Abstract: Effective operation of critical systems requires reliable designs that can be optimally maintained. However, system reliability optimization models and analyses involving multiple failure processes become very challenging when the failure processes, such as degradation failures and random shocks, are competing and dependent. For reliability modeling of these complex multiple component systems, component failure time and/or degradation are often assumed to be independent as a simplifying assumption, although this is not always the case for actual engineering systems. In this paper, we extend maintenance and design optimization models to incorporate dependent failures and combined decision-making processes. Traditionally, analytical models for system design and maintenance planning have been applied sequentially; however, this is potentially inefficient. Cost effective design and maintenance planning policies can be achieved by combining the respective the decision-making processes. A modeling approach, formulated as a two-stage stochastic optimization problem, is presented to simultaneously design a multi-component system and a maintenance plan with dependent failure processes and uncertain future stress exposure, and to minimize the system cost rate. This is on-going research but preliminary results show advantages of the proposed integrated model.

Speaker Bio: David Coit is a Professor in the Department of Industrial & Systems Engineering at Rutgers University, Piscataway, NJ, USA, with visiting professor positions at Université Paris-Saclay, Paris, France and Tsinghua University, Beijing, China. His current teaching and research involves system reliability modeling and optimization, and energy systems optimization. He has over 140 published journal papers and over 100 peer-reviewed conference papers (h-index 64). He is currently an Associate Editor for IEEE Transactions on Reliability and Journal of Risk and Reliability and for 15 years was a Department Editor for IISE Transactions. His research has been funded by USA National Science Foundation (NSF), U.S. Army, U.S. Navy, industry, and power utilities. His NSF grants included a CAREER grant to develop new reliability optimization algorithms considering uncertainty. He was also the recipient of the P. K. McElroy award, Alain O. Plait award and William A. J. Golomski award for best papers and tutorials at the Reliability and Maintainability Symposium (RAMS). Prof. Coit received a BS degree in mechanical engineering from Cornell University, an MBA from Rensselaer Polytechnic Institute, and MS and PhD in industrial engineering from the University of Pittsburgh. He is a fellow of IISE.



C. Keynote Speech 3



Thursday, July 25 / 10:15-10:55, Grand Ballroom

Title: Reliability Evaluation of Modular Software Systems with Bug Prediction

Tadashi Dohi, PhD, Professor Hiroshima University, Hiroshima, Japan

Abstract: Software bug prediction aims at predicting bug-prone modules in advance during the module testing, and is reduced to a statistical discrimination problem, where several kinds of machine learning algorithms are applied to predict the bug-prone probability in each module before conducting the module test. However, it should be noted that the reliability evaluation of modular software systems with bug prediction has not been considered yet in the past literature. In my talk, we focus on the fact that estimates of the bug-prone probabilities are mutually independent but not identical, and develop a reliability evaluation method for the modular software systems with bug prediction. Throughout numerical illustrations with actual software development project data, we present how to utilize our reliability modeling and inference in the testing of modular software systems.

Speaker Bio: Tadashi Dohi has served as a Full Professor at Hiroshima University, Japan, since 2002. He is currently appointed as Dean of School of Informatics and Data Science and Associate Dean of Graduate School of Advanced Science and Engineering, Hiroshima University. He received a Doctor of Engineering degree from Hiroshima University in 1995. His research interests include Software Reliability, Dependable Computing, Performance Evaluation, Operations Research. To date, his research has led to 280 journal papers, 340 peer-reviewed conference papers, 25 book editions, and 47 book chapters in the above research fields. Dr. Dohi is a Regular Member of IEICE, IPSJ, REAJ, a Fellow Member of ORSJ, and a Senior Member of IEEE (Computer Society and Reliability Society). He was acting President of REAJ in 2018 and 2019. He has served as the General Chair of 15 international conferences, including ISSRE 2011, ATC 2012, DASC 2019, and ICECCS 2022. Of note, he was a founding member of the International Symposium on Advanced Reliability and Maintenance Modeling (APARM) and International Workshop on Software Aging and Rejuvenation (WoSAR). He has been a steering committee member in AIWARM/APARM, ISSRE, DASC, DSA. He has also worked as a program committee member in several premier international conferences such as DSN, ISSRE, COMPSAC, SRDS, QRS, EDCC, PRDC, HASE, SAC, ICPE, among numerous others. He is an Associate Editor/Editorial Board Member of over 20 international journals, including IEEE Transactions on Reliability.



D. Keynote Speech 4



Thursday, July 25 / 10:55-11:35, Grand Ballroom

Title: Safety and Reliability of Autonomous Systems – from Design, Development to Operation

Min Xie, PhD, Chair Professor Member of European Academy of Sciences and Arts Fellow of IEEE City University of Hong Kong, China

Abstract: Autonomous vehicle is probably the most widely discussed applications of AI techniques and broadly speaking, autonomous systems have helped us to improve the quality and productivity, at work and at home. However, as many of intelligent systems are also safety-critical, how to design and develop such system is of great concern. Testing and managing the operation of such system will also be very critical. We cannot wait till systems are fully developed and operational, and managing the design and development of AI systems is what engineering management community should pay attention to. Furthermore, for intelligent systems, the data availability and accuracy should also be considered and managed, especially due to the dynamic nature of the data sources and issues with sensor degradation. In this talk, some of these issues will be discussed, with reference to the development of autonomous vehicles and robotics in different applications.

Speaker Bio: Min Xie has been a chair professor of Chair Professor at City Univ of Hong Kong since 2011. Prior to that, he was with National Univ of Singapore for 20 years, where he joined as one of the first recipient of LKY research fellow. He entered USTC in 1978 and later received his undergraduate and postgraduate education in Sweden. He has carried out extensive research in quality, reliability and industrial engineering, and published over 300 journal papers and 10 books. He has advised 60 PhD students, now working in industry or academia in different continents. He was elected IEEE fellow in 2005 and in 2022 to European Academy of Sciences and Arts. Prof Xie currently the IEEE Technology and Engineering Management Society's Fellow Evaluation Committee Chair.



E. Keynote Speech 5



Thursday, July 25 / 11:35-12:15, Grand Ballroom

Title: Research on Intelligent Sensing Technology of Motor System

Pinjia Zhang, PhD, Professor

Department of Electrical Engineering, Tsinghua University, China

Abstract: The motor system is the heart of modern industry and the core equipment for achieving the "dual carbon" goal. Various cutting-edge applications have challenged the reliability of the motor system under complex working conditions. In response to this demand, intelligent sensing methods are studied from the aspects of electricity, mechanics, and heat to achieve high-precision intelligent sensing of multiple physical quantities based on electromagnetic signals. First, an insulation fault early warning method based on leakage current measurement is proposed. According to the electromagnetic modal difference between the motor leakage current and the load current, an electromagnetic filtering structure is designed to form a high-precision leakage current sensing technology, which realizes online monitoring of insulation health and fault early warning; second, an intelligent sensing method for transmission chain faults based on electromagnetic torque is proposed. The external perception based on vibration signals is transformed into the internal perception based on electromagnetic torgue, and the motor is transformed from a "power heart" to a "sensor", and transmission chain fault diagnosis can be achieved without additional vibration sensors; third, the limit capacity control based on thermal perception is proposed. Based on the high-precision motor stator and rotor and power electronics temperature sensing method, combined with the electromagnetic thermal coupling model, the maximum output capacity of the motor is maximized within the thermal constraint.

Speaker Bio: Pinjia Zhang is currently the deputy director of the Department of Electrical Engineering at Tsinghua University. He is a professor, doctoral supervisor, and winner of the National Science Fund for Distinguished Young Scholars. He received funding from the Young Thousand Talents Program in 2015, the Excellent Young Scientists Fund in 2018, and the Outstanding Youth Achievement Award from IEEE Industrial Applications Society as the first mainland winner in 2018. He won the Academic Newcomer Award of Tsinghua University in 2019, and the Delta Young Scholar Award in 2021. He won the first prize of the Science and Technology Award of the China Electrotechnical Society and the Gold Medal of the Geneva International Invention Exhibition as the first finisher. In 2022, he received funding from the National Science Fund for Distinguished Young Scholars. He is mainly engaged in research related to the reliability of large-capacity power electronics and electrical equipment, focusing on online monitoring and health management of electrical equipment. He serves as an editorial board member of IEEE Transactions on Industrial Electronics, IEEE Transactions on Industry Applications, and other magazines. He serves as the chairman and convener of the CIGRE/A1.45 Motor System Online Monitoring Standards Committee, and participated in the organization of four IEEE standards. He has published more than 80 papers as the first/corresponding author in various IEEE transactions. He has been honored with the Best Paper Award from IEEE Transactions on Energy Conversion, and also has won the Best Paper Award from the IEEE IAS and IES Motor Committee three times.



F. Keynote Speech 6



Friday, July 26 / 08:30-09:10, Grand Ballroom

Title: Reliability in the Internet of Things

Liudong Xing, PhD, Professor University of Massachusetts, Dartmouth, USA

Abstract: The Internet of Things (IoT) aims to enable seamless connections between people and diverse objects, transforming our society toward becoming efficient, smart, and convenient incurring potentially vast economic and environmental benefits. During the past decade, the IoT technology has developed rapidly in various application domains, spanning from smart healthcare to smart energy, smart manufacturing to smart agriculture, smart environmental monitoring to smart ocean, smart cities to smart supply chains, and so on. Due to the critical nature of IoT applications, reliability is a vital requirement for deploying and operating robust IoT systems. Based on a layered IoT architecture, this talk presents the reliability-related issues and research on IoT systems. Particularly, reliability modeling, analysis, and design issues and solution methods will be discussed for the IoT perception technologies, IoT data communications, IoT support technologies, and IoT applications and services. Several open problems in the reliability of IoT will also be presented.

Speaker Bio: Liudong Xing is a Professor at the University of Massachusetts, Dartmouth, USA. She received her PhD in Electrical Engineering from the University of Virginia, Charlottesville in 2002. Her research interests include reliability and resilience modelling, analysis and optimization of complex systems and networks. She is the author or co-author of over 300 journal articles and three books entitled "Reliability and Resilience in the Internet of Things", "Binary Decision Diagrams and Extensions for System Reliability Analysis", and "Dynamic System Reliability: Modeling and Analysis of Dynamic and Dependent Behaviors". Prof. Xing has received multiple teaching and scholar awards, including the 2015 Changjiang Scholar Award. She was also corecipient of 2018 Premium Award for Best Paper in the journal of IET Wireless Sensor Systems, and the Best (Student) Paper Award at several international conferences. She currently serves as Associate Editor or Editorial Board member for multiple journals including IEEE Internet of Things Journal, Reliability Engineering & System Safety, IEEE Access, etc. She is IEEE ComSoc Distinguished Lecturer for the class of 2024-2025. She has been the IEEE ComSoc IoT-AHSN TC SIG chair for "IoT in Tactile Internet" since 2023. She is a fellow of the International Society of Engineering Asset Management and a senior member of IEEE.



G. Keynote Speech 7



Friday, July 26 / 09:10-09:50, Grand Ballroom

Title: A Brief History of Reliability Engineering and Future Challenges

Loon Ching Tang, PhD, Professor Fellow of Academy of Engineering National University of Singapore, Singapore

Abstract: We first give an historical account of the origin of reliability engineering so as to understand how it has impacted the development of various major technological breakthroughs in the last 70 years. Knowing the past and how we get here today, we follow up by discussing some challenges that we face now and in the near future. The main objective of the talk is to provide an appraisal of the state of development of reliability and hope to provoke further thoughts and ideas on how we should respond to these challenges.

Speaker Bio: Loon Ching Tang is currently a professor of Department of Industrial Systems Engineering & Management at the National University of Singapore and a Fellow of the Academy of Engineering, Singapore. He obtained his Ph.D degree from Cornell University in the field of Operations Research in 1992 and has published extensively in areas related to industrial engineering and operations research. He has been presented with a number of best paper awards including the IIE Transactions 2010 Best Application Paper Award and 2012 R.A. Evans/P.K. McElroy Award for the best paper at Annual RAMS. Prof Tang is the main author of the award-winning book: Six Sigma: Advanced Tools for Black Belts and Master Black Belts. Besides being active in the forefront of academic research, in the last 30 years, Prof Tang has served as a consultant for many organizations, such as the Ministry of Home Affair, Singapore Power Grid, Republic of Singapore Air Force, Seagate, HP, Phillips, etc, on a wide range of projects aiming at improving organizational and operations excellence; especially through better management of engineering assets. He is currently a fellow of ISEAM, the Co-Editor-in-Chief of *Quality & Reliability Engineering International*, editorial review board member of *Journal of Quality Technology*.



H. Keynote Speech 8



Friday, July 26 / 09:50-10:30, Grand Ballroom

Title: Phase-changing Gels for Thermal and Electric Energy Harvesting

Insu Jeon, PhD, Professor

Chonnam National University, Korea

Abstract: Hydrated-salt-induced phase changes can be leveraged toward the development of cost-effective and environmentally friendly materials with many invaluable functions, including interchangeable states, energy (heat, electricity, and mechanical) harvesting, and switchable adhesion. However, the use of existing materials presents challenges such as limited supercooling, uncontrolled nucleation, a narrow operational temperature range, and cyclic instability, which collectively limit the practical applications of phase-changing gels. In this study, we propose a strategy that utilizes the synergistic effect of hydrated sodium acetate trihydrate (SAT) and glycerol to develop phase-changing gels with excellent supercoolability (below -80 °C). The proposed strategy concurrently resolves all the aforementioned issues by creating a stronger yet switchable solvation barrier around the salt ions in the gel network. As a proof of concept, we rationally integrate SAT and glycerol within a polymer gel matrix at the molecular level to develop a supersaturated glycerogel. This supersaturated glycerogel possesses a cyclic, on-demand, and sustainable (by concentrating sunlight) structural transformability (~2000-fold change in stiffness) and exhibits prolonged environmental and mechanical stability. In addition, we demonstrate its ability to generate high-performance heat (~42 °C) and thermoelectric voltages (~336 mV) at environmental temperatures of -30-37 °C. Furthermore, it exhibits stable shape adaptability (~100%) and shape-memory ability (~100%), along with extremely tough and reversible adhesiveness (debonding energy for gel/glass adhesion: ~800 J m-2). The utilization of the SAT/glycerol synergy promotes the development of diverse high-performance phase-changing gels for advanced medical and technological applications.

Speaker Bio: Insu Jeon is a professor at Chonnam National University, Gwangju, Korea. He received his B.S. degree in Mechanical Design Engineering from Pusan National University, Busan, Korea in 1993 and M.S. and Ph.D. degrees from Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, in 1995 and 2000, respectively. Prof. Insu Jeon initiated research on the development of various gels during a one-year visiting research period at Harvard University in USA starting in 2013. Since 2016, he has been conducting research on the development of various functional gels and has continuously published papers in prestigious international journals such as Progress in Materials Science, Advanced Materials, Advanced Functional Materials, Materials Horizons, Water Research, and the Chemical Engineering Journal. He has received various awards from the Korean Society of Mechanical Engineers, including Research Excellence Award (2022) and Experimental Mechanics Academic Award (2020) and the Reliability Academic Award (2016) in the Reliability Division, and Yoo-Dam Academic Award (2005) in the Materials and Fracture Division. He served as a Program Member (Review Board) of the National Research Foundation of Korea (NRF) from 2018 to 2021 and as the Chair of the Reliability Division of the Korean Society of Mechanical Engineers in 2019. He served as the chairman and a co-chairman of ICMR (International Conference on Materials and Reliability) held in Jeju, South Korea in 2019 and in Yamaguchi, Japan in 2022, respectively. He is currently serving as the editor of the Journal of the Korean Society of Mechanical Engineers, Series A (2023~). Furthermore, he is currently appointed as an adjunct professor at Zhejiang University in China.



I. Keynote Speech 9





Speaker B

Friday, July 26 / 10:40-11:20, Grand Ballroom

Title: Digital Model-Based System Engineering for Quality Consistency

Speaker A: Guofu Zhai, PhD, Professor Harbin Institute of Technology, China Speaker B: Xuerong Ye, PhD, Professor Harbin Institute of Technology, China

Abstract: Ensuring quality consistency in the manufacturing process of electronic components is crucial to product reliability and performance. Traditional manufacturing methods rely on human experience, leading to issues such as process parameter fluctuations and poor quality consistency. With the advancement of industrial intelligence and digital transformation, intelligent manufacturing based on digital models has garnered widespread attention. Applying digital models to relay manufacturing processes helps enhance process controllability and quality consistency of products. This report introduces a digital model-based system engineering approach to achieve product quality consistency. By establishing digital models, it is possible to better understand and control key parameters and processes in manufacturing, identify and trace process faults and variations. Utilizing digital models to define process modeling methods facilitates rapid process parameter optimization and product design. Through simulation analysis, potential manufacturing issues can be predicted and avoided, improving product guality consistency, reducing rework and waste, enhancing production efficiency, and lowering production costs, thereby promoting the transition of enterprises to intelligent manufacturing. The effectiveness of the digital model-based quality consistency systems engineering approach has been validated through a case study in electronic components. Optimized products showed significant improvements in reliability and lifespan, with noticeable enhancements in quality consistency. Overall, research on digital model-based quality consistency systems engineering for relay manufacturing processes can significantly boost the overall competitiveness of manufacturing enterprises and is a valuable area for further research.

Speaker A Bio: Guofu Zhai is currently a full professor at the School of Electrical Engineering and Automation, Harbin Institute of Technology, as well as the Chief Engineer of a pre-research project from National Ministries and Commissions and the Director of Key Laboratory of Electronic Component Reliability, Ministry of Education. He obtained his doctoral degree from Harbin Institute of Technology in 1998, focusing on research directions such as the reliability and quality consistency of electrical systems, electronic systems, and electronic components. Besides his active involvement in cutting-edge academic research,



Prof. Zhai has served various organizations over the past 30 years. He holds positions such as Vice Chairman of the Science and Technology Committee of China Electronic Components Association, Vice Chairman of National Standardization Technical Committees, Vice Chairman of the System Reliability Engineering Technical Committee of System Engineering Society of China, and Vice Chairman of the Electrical Products Reliability Technical Committee of China Electrotechnical Society. These roles aim to guide the improvement of reliability and quality consistency in the field of electrical systems, electronic systems, and electronic components. For his outstanding contributions, Prof. Zhai was awarded one Second Prize of National Science and Technology Progress Award, two First Prize of National Science and Technology Progress Award, two First Prize of National Science and Technology Progress Awards.

Speaker B Bio: Xuerong Ye has been a full professor at Harbin Institute of Technology since 2018. He currently holds the positions of Dean of the School of Electrical Engineering and Automation and Director of Heilongjiang Provincial Key Laboratory of Electrical and Electronic Reliability Technology. Prof. Ye obtained his Ph.D. in engineering from Harbin Institute of Technology in 2009. His research interests include physical modeling of failures, reliability prediction, and robust design for guality consistency in electrical and electronic systems. With years of deep cultivation in the above interests, Prof. Ye has been selected as a national-level young talent in China and serves as an IET Fellow, an IEEE Senior Member, an expert in the field of electronic components for national departments, a senior consultant for Second Research Academy of China Aerospace Science & Industry Corporation, an Executive Committee Member of the System Reliability Engineering Technical Committee of System Engineering Society of China, a Director of the Electrical Products Reliability Technical Committee of China Electrotechnical Society, and a Committee Member of the Test Technology and Instrumentation Professional Committee of Chinese Society for Electrical Engineering. Prof. Ye has received multiple awards, such as one First Prize of Science and Technology Progress Award from National Ministries and Commissions, one Second Prize of Science and Technology Progress Award from National Ministries and Commissions, and one Second Prize of Science and Technology Award from China Instrument and Control Society.



J. Keynote Speaker 10



Friday, July 26 / 11:20-12:00, Grand Ballroom

Title: Analysis of Operational Data to Support Maintenance Planning of Floating Offshore Wind Turbines

Carlos Guedes Soares, PhD, Distinguished Professor Member of the Portuguese Academy of Engineering Centre for Marine Technology and Ocean Engineering (CENTEC) Instituto Superior Técnico, Universidade de Lisboa, Portugal

Abstract: An overview of the overall wind energy production trends worldwide, including offshore evolution. The general characteristics and mode of operation of the wind turbines are presented, and the use of FMEA to identify the modes of failure and their risk levels is discussed. Reference is made to a recently acquired database of failure data of onshore and bottom-fixed offshore wind farms in China, discussing the features of the data and the assessments they allow. Given the lack of data for floating offshore wind turbines, a method is presented to adjust failure data from onshore to offshore conditions and from fixed offshore to floating offshore wind turbines, using expert opinions, and the problems of estimating failure rates of the various components are addressed. The use of artificial intelligence methods in the analysis of the data is discussed and some approaches are described. The support that data sets also provide to the analysis of maintenance actions is also discussed and some results are presented.

Speaker Bio: Carlos Guedes Soares is a Distinguished Professor of the Engineering School (Instituto Superior Técnico) of the University of Lisbon and Scientific Coordinator of the Centre for Marine Technology and Ocean Engineering (CENTEC), which is a research centre of the University of Lisbon, rated as "Excellent" and funded by the Portuguese Foundation for Science and Technology. He concluded his postgraduate studies at the Massachusetts Institute of Technology, USA, in 1976 and at the Norwegian Institute of Technology of the University of Trondheim in 1984. Since then, he has been at the University of Lisbon (Technical University of Lisbon until 2013). He has supervised and co-supervised more than 75 PhD students and has about 35,000 citations in the Web of Science. He has been Chair or Co-Chair of various conferences in the series of OMAE, ESREL, IMAM, ISSC, ICCGS, MARSTRUCT, MARTECH RENEW and QR2MSE. He has been Editor of the Reliability Engineering and Systems Reliability Journal for about 30 years, the last 10 of which as Editor-in-Chief. He is Co-Editor-in-Chief of the Journal of Marine Science and Application and is a member of the Editorial Board of more than 15 Journals. He is a Fellow of SNAME, RINA, IMarEST, ASME and the Portuguese Engineering Association (Ordem dos Engenheiros). He was one of the five founding members of the European Safety and Reliability Association (ESRA), in which he was General Secretary, Vice-Chairman, Chairman and Newsletter Editor for many years. He is also a Member of the Portuguese Academy of Engineering.



V. Program Information

- A. Conference Topics
- I Reliability Modeling and Risk Analysis
- II Reliability, Maintainability, and Supportability
- III System Analysis, Simulation and Optimization
- IV Fault Diagnosis, Prognosis, Condition Monitoring and PHM
- V Robust, Reliability-Based, and Lifecycle Design
- VI Maintenance and Warranty Management
- VII Failure Physics, Material Science, Data Analysis, and Reliability Testing



B. Program at A Glance

Date Time	July 24 (Wednesday)	July 25 (Thursday)	July 26 (Friday)	July 27 (Saturday)
		Opening Ceremony	Keynote Speech 6	
		Keynote Speech 1	Keynote Speech 7	
		Keynote Speech 2	Keynote Speech 8	
08:30-12:15		Tea Break	Tea Break	Session E
		Keynote Speech 3	Keynote Speech 9	
		Keynote Speech 4		
		Keynote Speech 5	Keynote Speech 10	
12:15-14:00		Lunch	Lunch	Lunch
		Session A	Session C	
14:00-18:30	Registration	Tea Break	Tea Break	
		Session B	Session D	
18:30	Dinner	Dinner	Banquet	



C. Detailed Timetable

12:15-14:00

July 25 [Thursday] 8:30-12:15 Room **Grand Ballroom** Time 08:30-08:45 **Opening Ceremony Keynote Speech 1:** Chair: Dong Ho Park, PhD, Professor, Prof. Xiaoyue Wu, National University of 08:45-09:25 Korean Academy of Science and Technology, Korea Defense Technology, Maintenance and Warranty Policy for Repairable China System Subject to Lemon Law Conditions **Keynote Speech 2:** Chair: David Coit, PhD, Professor, Prof. Renvan Jiang, 09:25-10:05 Rutgers University, Piscataway, NJ, USA Wenzhou University. Maintenance and Design Optimization for Systems China of Dependent Degrading Components 10:05-10:15 Tea Break **Keynote Speech 3:** Chair: Tadashi Dohi, PhD, Professor, Prof. Jae-Hak Lim. 10:15-10:55 Hanbat National Hiroshima University, Hiroshima, Japan University, **Reliability Evaluation of Modular Software Systems** Korea with Bug Prediction Keynote Speech 4: Chair: Min Xie, PhD, Chair Professor, Prof. Baisong Pan, 10:55-11:35 Zhejiang University of City University of Hong Kong, Hong Kong, China Technology, Safety and Reliability of Autonomous Systems China - from Design, Development to Operation Keynote Speech 5: Chair: Pinjia Zhang, PhD, Professor Prof. Yu Liu. University of Electronic Department of Electrical Engineering, Tsinghua 11:35-12:15 Science and Technology University, China of China. **Research on Intelligent Sensing Technology of Motor** China System



July 25 [Thursday] 14:00-16:00

Time	Room	Function Room 1	Function Room 2	Function Room 3	VIP Room	Meeting Room
Conference Topic		Machine Learning-Assisted Uncertainty Quantification for Engineering Structures	Challenge of Extreme Environmental Reliability, from Electronic Components to Systems	Deep Learning Based Fault Diagnosis and Prognostics Under Varying Model Development Resources	Korean Activities on Reliability and Structural Integrity	Reliability and Maintenance Planning for Renewable Energy Systems
	14:00-14:20	QR2MSE 2024-01-0049	QR2MSE 2024-07-0007	QR2MSE 2024-04-0058	QR2MSE 0009-1001	QR2MSE 2024-10-0001
	14:20-14:40	QR2MSE 2024-01-0051	QR2MSE 2024-07-0008	QR2MSE 2024-03-0042	QR2MSE 0009-1002	QR2MSE 2024-10-0002
Session	14:40-15:00	QR2MSE 2024-03-0025	QR2MSE 2024-07-0015	QR2MSE 2024-04-0012	QR2MSE 0009-1003	QR2MSE 2024-10-0003
A	15:00-15:20	QR2MSE 2024-03-0030	QR2MSE 2024-08-0028	QR2MSE 2024-04-0018	QR2MSE 0009-1004	QR2MSE 2024-10-0004
	15:20-15:40	QR2MSE 2024-01-0038	QR2MSE 2024-08-0023	QR2MSE 2024-04-0065	QR2MSE 0009-1005	
	15:40-16:00	QR2MSE 2024-03-0044	QR2MSE 2024-07-0040			
16:00-16:30		Tea Break				

July 25 [Thursday]

16:30-18:30

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Time	Room	Function Room 1	Function Room 2	Function Room 3	VIP Room	Meeting Room
Conference Topic		Machine Learning-Assisted Uncertainty Quantification for Engineering Structures	Warranty and Maintenance	Predictive Maintenance for Intelligent Manufacturing Systems	Reliability Analysis and Maintenance Management of Engineered Systems	Advanced Quality Modeling and Control Methods for Manufacturing Engineering
	16:30-16:50	QR2MSE 2024-04-0020	QR2MSE 2024-06-0003	QR2MSE 2024-05-0008	QR2MSE 2024-01-0029	QR2MSE 2024-03-0023
	16:50-17:10	QR2MSE 2024-08-0014	QR2MSE 2024-08-0013	QR2MSE 2024-08-0019	QR2MSE 2024-03-0024	QR2MSE 2024-01-0022
Session	17:10-17:30	QR2MSE 2024-08-0024	QR2MSE 2024-08-0007	QR2MSE 2024-08-0020	QR2MSE 2024-06-0007	QR2MSE 2024-02-0015
В	17:30-17:50	QR2MSE 2024-02-0012	QR2MSE 2024-08-0010	QR2MSE 2024-04-0063	QR2MSE 2024-06-0002	QR2MSE 2024-03-0017
	17:50-18:10	QR2MSE 2024-08-0029	QR2MSE 2024-08-0003	QR2MSE 2024-03-0028	QR2MSE 2024-06-0008	QR2MSE 2024-07-0039
	18:10-18:30	QR2MSE 2024-08-0030	QR2MSE 2024-01-0031	QR2MSE 2024-08-0022	QR2MSE 2024-01-0013	QR2MSE 2024-08-0011
18:30				Dinner		



July 26 [Friday] 08:30-12:00

Room Time	n Grand Ballroom		
08:30-09:10	Chair: Assoc. Prof. Rui Peng, Beijing University of Technology, China	Keynote Speech 6: Liudong Xing, PhD, Professor, University of Massachusetts, Dartmouth, USA Reliability in the Internet of Things	
Chair: Prof. Shichang Du, 09:10-09:50 Shanghai Jiao Tong University, China		Keynote Speech 7: Loon Ching Tang, PhD, Professor, National University of Singapore, Singapore A Brief History of Reliability Engineering and Future Challenges	
09:50-10:30	Chair: Prof. Hui Xiao, Southwestern University of Finance and Economics, China	Keynote Speech 8: Insu Jeon, PhD, Professor, Chonnam National University, Korea Phase-changing Gels for Thermal and Electric Energy Harvesting	
10:30-10:40		Tea Break	
10:40-11:20	Chair: Prof. Nam-Su Huh, Seoul National University of Science and Technology, Korea	Keynote Speech 9: Guofu Zhai, PhD, Professor, Harbin Institute of Technology, China Xuerong Ye, PhD, Professor, Harbin Institute of Technology, China Digital Model-Based System Engineering for Quality Consistency	
11:20-12:00	Chair: Prof. Hong-Zhong Huang, University of Electronic Science and Technology of China, China	Keynote Speech 10: Carlos Guedes Soares, PhD, Distinguished Professor, Engineering Faculty, University of Lisbon, Portugal Analysis of Operational Data to Support Maintenance Planning of Floating Offshore Wind Turbines	
12:00-14:00	Lunch		



July 26 [Friday] 14:00-16:00

Time	Room	Function Room 1	Function Room 2	Function Room 3	VIP Room	Meeting Room
Conference Topic		Efficient Uncertainty Modeling and Reliability Assessment Methods for Engineering Structures	Digitalization for Safety and Reliability of Nuclear Installations	Probabilistic Modelling of the Degradation in Structures and Systems	Safety of Waterborne Transportation	Reliability Analysis and Optimization of Complex Systems and Networks
	14:00-14:20	QR2MSE 2024-05-0001	QR2MSE 2024-01-0066	QR2MSE 2024-01-0018	QR2MSE 2024-01-0014	QR2MSE 2024-01-0032
	14:20-14:40	QR2MSE 2024-01-0055	QR2MSE 2024-01-0070	QR2MSE 2024-01-0056	QR2MSE 2024-01-0017	QR2MSE 2024-02-0030
Session	14:40-15:00	QR2MSE 2024-02-0008	QR2MSE 2024-01-0071	QR2MSE 2024-04-0014	QR2MSE 2024-01-0046	QR2MSE 2024-06-0012
С	15:00-15:20	QR2MSE 2024-02-0027	QR2MSE 2024-02-0029	QR2MSE 2024-07-0029	QR2MSE 2024-01-0050	QR2MSE 2024-01-0034
	15:20-15:40	QR2MSE 2024-04-0013	QR2MSE 2024-03-0046	QR2MSE 2024-04-0064	QR2MSE 2024-03-0033	QR2MSE 2024-01-0040
	15:40-16:00	QR2MSE 2024-04-0027	QR2MSE 2024-03-0050	QR2MSE 2024-08-0027	QR2MSE 2024-05-0011	QR2MSE 2024-01-0043
16:00-16:30				Tea Break		

July 26 [Friday] 16:30-18:30

Function Function Function Room VIP Room **Meeting Room** Time Room 1 Room 2 Room 3 Digitalization Reliability System Reliability, for Safety and Design and **Reliability Modeling** Analysis, Maintainability, **Conference Topic** Reliability of Assessment of and Risk Analysis Simulation and and Nuclear Nuclear Power Optimization Supportability Installations Facilities QR2MSE QR2MSE QR2MSE QR2MSE QR2MSE 16:30-16:50 2024-05-0003 2024-04-0034 2024-01-0077 2024-02-0022 2024-11-0001 QR2MSE QR2MSE QR2MSE QR2MSE QR2MSE 16:50-17:10 2024-07-0014 2024-04-0051 2024-01-0078 2024-11-0002 2024-03-0011 QR2MSE QR2MSE QR2MSE QR2MSE QR2MSE 17:10-17:30 2024-08-0004 2024-06-0010 2024-03-0016 2024-11-0003 2024-07-0003 Session D QR2MSE QR2MSE QR2MSE QR2MSE QR2MSE 17:30-17:50 2024-08-0017 2024-03-0048 2024-03-0051 2024-11-0004 2024-02-0024 QR2MSE QR2MSE QR2MSE QR2MSE QR2MSE 17:50-18:10 2024-08-0018 2024-04-0053 2024-04-0055 2024-11-0005 2024-04-0025 QR2MSE QR2MSE QR2MSE 18:10-18:30 2024-01-0037 2024-07-0026 2024-08-0025 18:30 Banquet



July 27 [Saturday] 08:30-10:30

Time	Room	Function Room 1	Function Room 2	Function Room 3	VIP Room	Meeting Room
Conference Topic		Reliability Modeling and Analysis of Complex Systems Considering Imperfect Information and Mixed Uncertainty	Predicting and Optimizing Multi-Objective Reliability of Complex Systems Based on Digital Models and Experiments	Fault Diagnosis, Prognosis, Condition Monitoring and PHM	Intelligent Diagnostics and Prognostics with Sensor Configuration Design for Industrial Systems	Reliability Modeling and Risk Analysis
	08:30-08:50	QR2MSE 2024-01-0073	QR2MSE 2024-04-0061	QR2MSE 2024-04-0026	QR2MSE 2024-04-0039	QR2MSE 2024-01-0076
	08:50-09:10	QR2MSE 2024-01-0015	QR2MSE 2024-05-0006	QR2MSE 2024-04-0044	QR2MSE 2024-04-0048	QR2MSE 2024-01-0081
Session	09:10-09:30	QR2MSE 2024-01-0025	QR2MSE 2024-07-0016	QR2MSE 2024-04-0045	QR2MSE 2024-04-0066	QR2MSE 2024-06-0005
E	09:30-09:50	QR2MSE 2024-03-0031	QR2MSE 2024-07-0017	QR2MSE 2024-04-0046	QR2MSE 2024-04-0050	QR2MSE 2024-01-0047
	09:50-10:10	QR2MSE 2024-01-0072	QR2MSE 2024-06-0004	QR2MSE 2024-04-0049	QR2MSE 2024-04-0062	QR2MSE 2024-01-0074
	10:10-10:30	QR2MSE 2024-01-0039	QR2MSE 2024-03-0034	QR2MSE 2024-04-0071		
11:30				Lunch		



VI. Technical Program

July 25 [Thursday] Special Session A in Function Room 1

14:00-16:00	Machine Learning-Assisted Uncertainty Quantification for Engineering Structures
Moderators:	Assoc. Prof. Jingwen Song, Northwestern Polytechnical University, China
	Assoc. Prof. Pengfei Wei, Northwestern Polytechnical University, China

 14:00-14:20
 QR2MSE2024-01-0049
 Rare Reliability Analysis by Beta-Surfaces and Kriging Model / Fangqi Hong (Northwestern Polytechnical University), Pengfei Wei

 Summary:
 This paper proposes a stratified beta-spheres method (SBS) for reliability analysis of rare and multiple failure domains in structural safety assessment and demonstrates its effectiveness through numerical examples.

 14:20-14:40
 QR2MSE2024-01-0051
 An Active Learning Method Based on Deep Neural Network and Monte Carlo

 Dropout for Function Approximation / Jinxing Liu (Leibniz Universität Hannover), Yan Shi, Michael Beer
 Summary: This paper proposes a novel adaptive framework for efficient high-dimensional function

 approximation, and a deep neural network (DNN) is utilized to enhance performance.

14:40-15:00 QR2MSE2024-03-0025 A Novel Adaptive Coevolution Based Multi-Objective Robust Optimization Strategy / Anai Ding (Nanjing University of Aeronautics and Astronautics), Tongkun Xu, Hongshuang Li, Haoyuan Di, Yi Li
 Summary: This paper proposes a new algorithm called AC-MORO, which can effectively address robust design under interval uncertainty.

15:00-15:20 QR2MSE2024-03-0030 Bayesian Updating for Thermal Model of Laser Powder-Bed Fusion Additive Manufacturing / *Jingwen Song* (*Northwestern Polytechnical University*), *Zhihao Jiang, Pengfei Wei Summary:* In this paper, a Bayesian Updating with Structural reliability method (BUS) is proposed to fulfill the calibration task, in which the proposed methodology entails Bayesian model updating theory to calibrate an established thermal model.

15:20-15:40 QR2MSE2024-01-0038 Prostate Cancer Diagnosis Using Resampling Technology and Extra Trees / *Zhentao Xiao* (*Northwestern Polytechnical University*), *Tianyi Wang, Shuai Zhang, Zhiqiang Cai Summary:* This study employs machine learning techniques, particularly the Extra Trees model, to enhance prostate cancer diagnosis and treatment in China, demonstrating superior performance through dataset filling, balancing, and classifier comparison.

15:40-16:00 QR2MSE2024-03-0044 Level Set Method for Structure Topology Optimization with Asymmetrical Microstructure Model / Jiaqi Wu (Hebei University of Technology), Haipeng Jia, Li Dong, Jingxuan Dou, Yajin Li

Summary: In this paper, a topology optimization algorithm for granular material structures is developed based on the parameterized level set method to solve the zig-zagged boundary.



July 25 [Thursday] Oral Session A in Function Room 2

14:00-16:00 Challenge of Extreme Environmental Reliability, from Electronic Components to Systems

Moderators: Prof. Jiaxin You, Harbin Institute of Technology, China Prof. Zhiqiang Cai, Northwestern Polytechnical University, China

14:00-14:20 QR2MSE2024-07-0007 Study of Electrical Contact Performance of Slotted Contacts for Electrical Connectors Under Fretting Wear Conditions / Yuyao Zhao (Harbin Institute of Technology), Le Xu, Shujuan Wang

Summary: The paper analyzes the degradation pattern of electrical contact performance of slot electrical connectors under frictional wear conditions

- 14:20-14:40 QR2MSE2024-07-0008 An Approach for Analyzing IC Quality of Wafer Level Based on Its Circuit Probe Data Set / Kai Sun (Institute of Microelectronics of Chinese Academy of Sciences), Panpan Zhang, Yingjun Shen, Jingyuan Xu, Hanbo Jia, Xuan Guo Summary: The paper converts 3D circuit probe data into a 2D comprehensive quality spectrum using Hilbert scanning, enabling qualitative and quantitative assessments of chip quality and fault correlations.
- 14:40-15:00 QR2MSE2024-07-0015 Methods of Designing Accelerated Reliability Verification Tests for Electrical Energy Meters Based on Lomax Distribution / Qihong Chen (Harbin University of Science and Technology), Wei Zhang, Ning Li, Yinping Bai, Jia Qi, Yongquan Sun Summary: The paper analyzes the degradation of electrical contact performance in slotted electrical connectors under fretting wear, identifying three stages of contact resistance change and examining the impact of vibration stress on the wear process.

15:00-15:20 QR2MSE2024-08-0028 A Reliability Assessment Method for SPCU Considering the Uncertainty of Environment Profile / Ying Zeng (University of Electronic Science and Technology of China), Jing Li, Xuliang Zhao, Jianping Tan, Hong-Zhong Huang Summary: In this article, a time-variant reliability assessment method for the components of SPCUs considering environment profile uncertainty is investigated based on the surrogate model

15:20-15:40 QR2MSE2024-08-0023 A Preventive Maintenance Optimization Framework Considering Energy Consumption Process and Production Wait / Yuxin Xian (Southwestern University of Finance and Economics), Hui Xiao Summary: Using a power plant as an example, this paper studies the failure behavior and energy consumption of the power generation system, dividing failure behavior into normal and defective stages.

15:40-16:00 QR2MSE2024-07-0040 Research on the Degradation Process and Failure Mechanism of High Voltage DC Contactor in Electrical Endurance Experiment / *Zhihao Gu (Harbin Institute of Technology), Chengchuang Wu, Chao Zhang, Yubin He, Wanbin Ren Summary:* This paper carries out an electrical endurance experiment of a typical HVDC contactor under resistive load.



July 25 [Thursday] Oral Session A in Function Room 3

14:00-15:40	Deep Learning Based Fault Diagnosis and Prognostics Under Varying Model Development Resources
Moderators:	Assoc. Prof. Weiwen Peng, Sun Yat-sen University, China
	Lect. Chenggeng Huang, University of Electronic Science and Technology of China, China

14:00-14:20 QR2MSE2024-04-0058 A Resilient Collaborative Prognostic Method Under Poisoning-Attacks Scenarios / Chenggeng Huang (University of Electronic Science and Technology of China), Guozhong Fu, Yifan Li
 Summary: A novel collaborative fault prognostic method equipped with a risk-averse aggregation mechanism within the FL framework is proposed in this article.

14:20-14:40 QR2MSE2024-03-0042 An Enhanced VTS Radar Target Tracking Method Addressing Target Splitting with Integrated Reasoning / *Mai Xiong (Wuhan University of Technology), Chi Tian, Bing Wu Summary:* In this paper, a target tracking technique designed to resolve the issue of target splitting in VTS radar imagery is proposed, in which an additional reasoning mechanism is designed to improve the effectiveness of target detection.

 14:40-15:00
 QR2MSE2024-04-0012
 Lithium-Ion Battery RUL Prediction Based on Multi-Modal Historical Data /

 Yuhang Du (Harbin Institute of Technology), Guangyuan Zeng, Lingjun Yu, Yuchen Song

 Summary: This paper proposes a new method based on multi-modal historical data for battery remaining useful life (RUL) prediction.

 15:00-15:20
 QR2MSE2024-04-0018
 Remaining Useful Life Prediction of Rolling Bearings Based on TCN-LSTM /

 Zhengwei Dai (Guangdong Ocean University), Qiang Liu, Peirong Chen, Hongxi Lai, Youlin Liang,

 Minghao Chen, Xiaoming Xu, Mingxin Hou, Guangbin Wang

 Summary: This paper introduces a residual remaining useful life prediction method for bearings based on

 TCN-LSTM.

15:20-15:40 QR2MSE2024-04-0065 Fault Diagnosis of Aero-Engine Bearings in Comprehensive Noise Environments Based on Multi-Scale Attention Residual Networks / Hongbo Ran (University of Electronic Science and Technology of China), Wenhao Deng, Jie Wang, Jinhua Mi, Shengjie Yin Summary: For aero-engines operating in harsh environments, the presence of substantial noise poses challenges to effective fault diagnosis, a multi-scale attention residual network (MARN) is proposed in this article.



July 25 [Thursday] Special Session A in VIP Room

14:00-15:40 Korean Activities on Reliability and Structural Integrity

Moderators: Prof. Nam-Su Huh, Seoul National University of Science and Technology, Korea Dr. Dong-Cheon Baek, Korea Institute of Machinery & Materials, Korea

 14:00-14:20
 QR2MSE-0009-1001
 Validation of New Elastic-Plastic Fracture Parameter Prediction Expressions Using

 3-D Finite Element Analyses / Nam-Su Huh (Seoul National University of Science and Technology),
 Jun-Geun Park, Seung-Hyun Park

Summary: This study validates newly proposed elastic-plastic J-integral estimates for circumferential surface cracks in cylinders using 3-D finite element analysis, showing excellent agreement with FE results and suitability for structural integrity assessments and probabilistic fracture mechanics applications.

14:20-14:40 QR2MSE-0009-1002 A Reduced Thickness-Based Maximum Loads Predictions of Complex Cracks in Cylinders / Ju-Won Choi (Seoul National University of Science and Technology), Min-Young Song, Nam-Su Huh Summary: This study demonstrates that the innovative Net-Section-Collapse method, validated through finite element limit analysis and assessed via the Crack Driving Force Diagram method, effectively predicts the fracture behavior of complex cracks in cylindrical structures, showing good agreement with experimental results.

14:40-15:00 QR2MSE-0009-1003 A Measure for Reliability as a Customer Value / Dong-Cheon Baek (Korea Institute of Machinery and Materials)
 Summary: This paper reviews diverse measurement methods to effectively convey the value of reliability to customers, emphasizing the necessity of Fail-Safe Design alongside traditional reliability indicators, and discusses the importance of considering customer-specific usage conditions, maintainability, and supply chain criteria for comprehensive reliability assessment.

15:00-15:20 QR2MSE-0009-1004 Accelerated Life Testing for Enhancing Health Monitoring and Management of Vertical Multistage Centrifugal Pumps / Sang Hyuk Lee (Korea Institute of Machinery and Materials), Kyung Ho Sun, Jaehyung Kim, In-Sik Yoon Summary: This study performed accelerated life testing on vertical multistage centrifugal pumps to develop health indexes for monitoring and managing major components, enhancing the reliability and performance evaluation in water supply systems.

15:20-15:40 QR2MSE-0009-1005 A Study of Health Evaluation Using Vibration Data in an Industrial Motor / Jongrak Choi (Korea Electronics Technology Institute), Yongwoo Shin, Sungjin Yang Summary: This study enhances real-time fault diagnosis for industrial electric motors by employing an optimized SVC model using minimal characteristic factors derived from time series data, validated through 10-fold cross-validation to ensure robust classification accuracy.



July 25 [Thursday] Special Session A in Meeting Room

14:00-15:20 Reliability and Maintenance Planning for Renewable Energy Systems

- Moderators: Dr. Jichuan Kang, Harbin Engineering University, China Dr. He Li, University of Lisbon, Portugal
- 14:00-14:20
 QR2MSE2024-10-0001
 Intelligent Predictive Maintenance for Floating Offshore Wind Turbine Based on Deep Learning Approaches / Zifei Xu (University of Liverpool)

 Summary:
 In this talk, novel deep Learning approaches and interesting applications in terms of predictive maintenance for floating offshore wind turbines will be discussed.
- 14:20-14:40
 QR2MSE2024-10-0002
 Mooring System Reliability Analysis of Floating Wave Energy Converters / Sheng Xu (Jiangsu University of Science and Technology)

 Summary:
 In this talk, mooring systems of floating wave energy converters will be introduced followed by the reliability analysis methodology and applications.
- 14:40-15:00
 QR2MSE2024-10-0003
 Autonomous Inspections of Floating Wind Turbines Using Different Intelligent

 Marine Robots / Gong Xiang (Huazhong University of Science and Technology)
 Summary: In this talk, marine robots designed for operation and maintenance of floating offshore wind turbines will be discussed.
- **15:00-15:20** QR2MSE2024-10-0004 Safety Assessment and Optimal Design of Offshore Hydrogen Production and Storage Platforms / *Jichuan Kang (Harbin Engineering University)* Summary: In this talk, an offshore hydrogen production and storage platforms will be introduced together with its safety assessment and design optimization.



July 25 [Thursday] Special Session B in Function Room 1

16:30-18:30 Machine Learning-Assisted Uncertainty Quantification for Engineering Structures

Moderators: Assoc. Prof. Jingwen Song, Northwestern Polytechnical University, China Assoc. Prof. Pengfei Wei, Northwestern Polytechnical University, China

- 16:30-16:50 QR2MSE2024-04-0020 A Feature Extraction Enhancing-Based LSTM Integrated Deep Learning Model for Remaining Useful Life Prediction / Hanyue Wang (Beijing University of Aeronautics and Astronautics), Zhihua Wang, Qiong Wu, Zelong Mao, Shihao Cao, Lu Li Summary: This paper proposes a new RUL prediction method based on an integration of the residual dilated causal convolution and Long Short-Term Memory network (LSTM).
- 16:50-17:10 QR2MSE2024-08-0014 Efficient Global Sensitivity Analysis Method for Dynamic Models in High Dimensions / Luyi Li (Northwestern Polytechnical University), Iason Papaioannou, Daniel Straub Summary: In this paper, a novel method for efficient global SA of dynamic models with high-dimensional inputs is proposed by combining a new polynomial chaos expansion (PCE)-driven partial least squares (PLS) algorithm with the analysis of variance.
- 17:10-17:30 QR2MSE2024-08-0024 A Novel Adaptive Kriging-Based Robust Design Optimization Method with Aleatory and Epistemic Uncertainty / **Yuanzhuo Ma** (Hohai University), Chenxu Li, Hongshuang Li Summary: This paper presents a novel adaptive Kriging-based robust design optimization method with aleatory and epistemic uncertainty.
- 17:30-17:50 QR2MSE2024-02-0012 An Adaptive Sampling Method for Generating Boundary Scenarios of UAV Swarms Based on Gaussian Process Regression / Hanxu Jiang (National University of Defence Technology), Haiyue Yu, Jiang Jiang, Shuaiwen Tang, Xiaotong Xie Summary: This paper introduces an adaptive sampling process guided by a Gaussian Process Regression (GPR) surrogate model, adjusting the balance between exploration and exploitation of the scenario space to pinpoint critical areas of performance transition for UAV swarms.
- 17:50-18:10 QR2MSE2024-08-0029 Bayesian Network Modeling and System Reliability Assessment Through Integrating Domain Knowledge and Data / Junle Yu (Hunan University), Zhe Zhang Summary: This paper proposes a system reliability modeling and assessment method based on Bayesian network learning, proposing a Bayesian network structure learning algorithm that integrates domain structure knowledge to construct a reliability model structure.

18:10-18:30 QR2MSE2024-08-0030 Enhancing Remaining Useful Life Predictions in Industrial Systems Using Graph Transformer Networks / Sajawal Gul Niazi (University of Electronic Science and Technology of China), Hong-Zhong Huang Summary: The Graph Transformer Network (GTN) is introduced in this article, an innovative machine-learning framework that combines the strengths of Graph Neural Networks (GNNs) and Transformer Networks to enhance the accuracy and robustness of RUL predictions.



July 25 [Thursday] Special Session B in Function Room 2

16:30-18:30 Warranty and Maintenance

Moderators: Prof. Dae Kyung Kim, Chonbuk National University, Korea Prof. Zequn Wang, University of Electronic Science and Technology of China, China

- 16:30-16:50 QR2MSE2024-06-0003 Profit Maximization and Cost Minimization Considering Total Profit Function, Selling Price, and Warranty Cost / Dong Ho Park (Hallym University), Minjae Park, Kimun Jung Summary: The paper introduces a novel linear warranty period pricing strategy for products with increasing failure rates, balancing profit maximization and cost minimization, and providing optimal warranty durations and pricing, supported by practical numerical examples.
- 16:50-17:10 QR2MSE2024-08-0013 Imaging Quality Assessment of the Micro Fresnel Lens by Micro-Manufacturing Process / *Ho Cheol Lee (Hanbat National University), Truong Van Hu Summary:* In this paper, an innovative micromanufacturing and quality testing method is proposed for producing precise flat optics components.
- **17:10-17:30** QR2MSE2024-08-0007 A Study on NHPP Software Reliability Model with Weibull Fault Detection Rate with Finite Number of Faults Data / *Kwang Yoon Song* (*Chosun University*), *Inhong Chang Summary:* The paper proposes a new software reliability model using a non-homogeneous Poisson process (NHPP) with a Weibull fault detection rate and finite number of faults, demonstrating improved fit and predictive accuracy over existing NHPP models for estimating software reliability metrics.
- 17:30-17:50 QR2MSE2024-08-0010 The Optimal Replacement Policy for Second-Hand Product Under 2-Dimensional Maintenance Strategy / Jae Hak Lim (Hanbat National University), Dae Kyung Kim, Dong Ho Park
 Summary: The paper proposes an optimal replacement policy for second-hand products using a 2-dimensional maintenance strategy, minimizing long-run mean costs by determining optimal minimal repairs and repair time thresholds, validated with a numerical example using Weibull distributions.

17:50-18:10 QR2MSE2024-08-0003 Integrating Component Refurbishment and Spare Parts Ordering in a Condition-Based Maintenance Policy for Multi-Component Systems / Xia Tang (Southwestern University of Finance and Economics), Hui Xiao
 Summary: The paper develops an integrated condition-based maintenance policy using Markov Decision Process (MDP) to optimize component refurbishment and spare parts ordering, demonstrating cost savings and promoting sustainability through practical applications and numerical simulations.

18:10-18:30 QR2MSE2024-01-0031 Multi-Objective Optimization of Maintenance Policy Considering the Impact of Degradation of Spare Parts on the System / Jiahui Kong (Wenzhou University), Chenlan Zhang, Jieqing Huang, Xinai Li, Weichen Wang, Leiqing Chen
 Summary: This paper investigates a new approach to inventory management for wind turbine spare parts, aiming to mitigate the impact of soft failures and reduce maintenance costs



July 25 [Thursday] Special Session B in Function Room 3

16:30-18:30 Predictive Maintenance for Intelligent Manufacturing Systems

Moderators: Assoc. Prof. Zhen Chen, Shanghai Jiao Tong University, China Lect. Di Zhou, Donghua University, China

- 16:30-16:50 QR2MSE2024-05-0008 Multi-Objective Q-Learning Approach of Operation Mode Control and Predictive Maintenance for Phased Mission Manufacturing Systems / Yuqi Cai (Beihang University), Yihai He, Rui Shi, Haibin Cao, Hanjun Guo, Haiyun Lu Summary: A multi-objective optimization method of equipment Operation Mode Control (OMC) and Predictive Maintenance (PdM) for PMMSs is proposed, which adapts to mission phase shifts.
- 16:50-17:10 QR2MSE2024-08-0019 Spatial Attention Temporal Convolution Network Based Remaining Useful Life Prediction for Aero-Engine / *Ting Zhu* (*Shanghai Jiao Tong University*), *Zhen Chen, Di Zhou, Zhaoxiang Chen, Ershun Pan Summary:* In this article, an RUL prediction method is proposed with spatial attention temporal convolutional network (SATCN), obtaining valuable information according to the importance of different data

17:10-17:30 QR2MSE2024-08-0020 Integrated Optimization for X-Bar Control Chart, Preventive Maintenance and Production Rate / Yaping Li (Nanjing Forestry University), Zhen Chen, Tangbin Xia, Ershun Pan, Sifeng Liu
 Summary: A stochastic process to describe the system's deterioration is employed in this article, enabling to address a broad range of deterioration scenarios and failure modes in the integrated optimization.

17:30-17:50 QR2MSE2024-04-0063 Integrated Optimization Model of Economic Manufacturing Quantity and Hybrid Condition-Based Maintenance for Continuous-Production Systems / Ruoran Han (Beihang University), Xiaobing Ma, Li Yang, Haibin Cao, Hanjun Guo, Haiyun Lu Summary: A proposed model integrates Economic Manufacturing Quantity (EMQ) optimization with hybrid maintenance scheduling, leveraging condition monitoring (CM) health data and using stochastic processes to describe manufacturing deterioration.

17:50-18:10 QR2MSE2024-03-0028 Joint Optimization of Serial System Based on Deep Reinforcement Learning / Zhenggeng Ye (Northwestern Polytechnical University), Zhiqiang Cai, Xin Wang, Shubin Si Summary: In this paper, a combined optimization model of rework and maintenance based on the DDQN algorithm is proposed to simulate and improve the rework and maintenance process and maximize system production efficiency and product quality.

 18:10-18:30 QR2MSE2024-08-0022 Joint Optimization Framework for Multi-Component Parallel Production: Coordinating Production Speeds, Spare Parts Procurement and Maintenance Management / Zhimin Chen (Southwestern University of Finance and Economics), Hui Xiao Summary: This paper proposes the joint optimization framework for multi-component parallel production.



July 25 [Thursday] Oral Session B in VIP Room

16:30-18:30 Reliability Analysis and Maintenance Management of Engineered Systems

Moderators: Prof. Yingkui Gu, Jiangxi University of Science and Technology, China Dr. Yixin Zhao, China University of Petroleum (East China), China

- 16:30-16:50 QR2MSE2024-01-0029 Maintenance Decision-Making for a Two-Component Buffered Serial Production System / Zitong Qiao (Wenzhou University), Jiaxiang Xie, Xinyi Fu, Zhenshan Zhang, Ruochen Wang, Lingbo Yu
 Summary: This paper presents a maintenance decision-making model for a two-component serial production system.
- 16:50-17:10
 QR2MSE2024-03-0024
 A General Framework for Optimal Discrete-Time Preventive Replacement Models / Jing Wu (Hiroshima University), Cunhua Qian, Tadashi Dohi

 Summary:
 In this paper, a definition of replacement option priority is introduced, and a general framework is proposed for optimizing replacement policies in discrete-time setting.
- 17:10-17:30 QR2MSE2024-06-0007 Research on Recovery Strategy of Production System Resilience Evaluation Based on Improved Node Importance / Jingxuan Wang (Beijing University of Aeronautics and Astronautics), Haibin Cao, Hanjun Guo, Wei Dai Summary: The paper presents a recovery strategy for production systems using improved node importance to prioritize machine repairs, enhancing system resilience as validated by the resilience triangle metric.
- 17:30-17:50 QR2MSE2024-06-0002 Load-Sharing and Maintenance Policy for Two-Unit Systems Under Dependent Bivariate Degradation Processes / Lu Jin (University of Electro-Communications), Ryoya Ashizawa, Watalu Yamamoto Summary: This research considers condition-based maintenance for a system consisting of two units for which the deterioration processes are mutually dependent.
- 17:50-18:10 QR2MSE2024-06-0008 Two-Dimensional Warranty Cost Analysis for Remanufactured Products Protected by Lemon Laws / Hennie Husniah (Langlangbuana University), Udjianna S.Pasaribu, Asep K.Supriatna, Bermawi P.Iskandar Summary: This paper deals with warranty cost analysis for a remanufactured warranted product protected by lemon laws during the two-dimensional warranty period.
- 18:10-18:30 QR2MSE2024-01-0013 Optimal Maintenance and Mission Abort Policy for a System with Two Competing Failures / Yanzhe Zhang (Wenzhou University), Hongming Zhou, Faqun Qi Summary: This paper presents a joint optimization of maintenance and mission abort policy for a system with two competing degradation processes.



July 25 [Thursday] Oral Session B in Meeting Room

16:30-18:30 Advanced Quality Modeling and Control Methods for Manufacturing Engineering

Moderators: Prof. Shichang Du, Shanghai Jiao Tong University, China

Prof. Yanfeng Li, University of Electronic Science and Technology of China, China

16:30-16:50 QR2MSE2024-03-0023 Analysis of Stress Influencing Factors in the Spring Tube Screw Connection Assembly of Electro-Hydraulic Servo Valve / **Dongxing Tao** (Beijing Institute of Spacecraft Environment Engineering), Xuelian Xiao, Qinglei Guo, Shaoming Kang, Shouwen Liu, Qingheng Zhou, Qingzhe Gao, Dongmei Wan

Summary: This paper presents an in-depth study of the stress and strain evolution of spring tube screw connection assemblies under various conditions, describes the assembly process of spring tubes, and provides an in-depth study of the stress relaxation characteristics of spring tube materials.

16:50-17:10 QR2MSE2024-01-0022 Numerical Study of Erosion Wear in Elbow Under the Action of Gas-Solid Flow / Lijing Mu (China Special Equipment Inspection & Research Institute), Shengxuan He, Guide Deng, Chongchong Zhang, Cenfan Liu Summary: In this paper a detailed study of hydrodynamics and erosion wear behavior is presented in CFD (Computational Fluid Dynamics) simulations for modeling elbow structures.

17:10-17:30 QR2MSE2024-02-0015 Failure Data Analysis for Tracked Vehicles Under Different Environments Using Principal Component Analysis / Junming Hu (Xihua University)
 Summary: This paper conducts the failure data analysis for tracked vehicles under different environments using principal component analysis.

17:30-17:50 QR2MSE2024-03-0017 Research on Real-Time Adaptive Adjustment Method for HSER Stable Manufacture and Consistent Quality / Leyu Chen (Institute of Reliability in Electrical Apparatus and Electronics, Harbin Institute of Technology), Jiaxin You, Yufei Qiao, Yue Ding, Rencong Liu Summary: In this article, the quality consistency of each batch is studied. The manufacture of a typical HSER model is analyzed, and the analyzed process is determined using single-factor analysis.

17:50-18:10 QR2MSE2024-07-0039 A New Part-Oriented Test Equipment for Evaluating the Mechanical Characteristics of Copper Alloy Spring Materials / Lizhi Sun (Harbin Institute of Technology), Chao Zhang, Yicheng Han, Wanbin Ren Summary: In this paper, a new automated test equipment for evaluating the mechanical characteristics of real part within the component of Copper alloy spring materials is developed

18:10-18:30 QR2MSE2024-08-0011 Reliability Modeling and Optimization of a Two-Dimensional System Considering Performance Sharing Mechanism / Yefang Chen (Southwestern University of Finance and Economics), Hui Xiao
 Summary: In this paper, the factory rooftop PV power generation system is modeled as a two-dimensional performance sharing system, in which a common bus exists in each row and across all rows.



July 26 [Friday] Oral Session C in Function Room 1

14:00-16:00Efficient Uncertainty Modeling and Reliability Assessment Methods for Engineering StructuresModerators:Prof. Baisong Pan, Zhejiang University of Technology, China

Asst. Prof. Yongyong Xiang, Zhejiang University of Technology, China

14:00-14:20 QR2MSE2024-05-0001 A High-Dimensional Reliability Analysis Method via Subspace Updating and Gaussian Process / Yifan Li (Zhejiang University of Technology), Yongyong Xiang, Baisong Pan, Luojie Shi Summary: The paper introduces a high-dimensional reliability analysis method combining manifold

Summary: The paper introduces a high-dimensional reliability analysis method combining manifold optimization and Gaussian process modeling to enhance subspace-based surrogate model accuracy, facilitating failure probability estimation, validated by two high-dimensional case studies.

14:20-14:40 QR2MSE2024-01-0055 Mixed Uncertainties Quantification of Rolling Bearings Based on Active Kriging Model / Hongyou Zhan (University of Electronic Science and Technology of China), Senlin Mu, Ningcong Xiao
 Summary: This study proposes a method for assessing time-dependent failure probabilities and predicting Mean Time to Failure (MTTF), suitable for mixed uncertainties, based on active learning Kriging models.

- 14:40-15:00
 QR2MSE2024-02-0008
 An Improved Method for Estimating Bootstrap Confidence Interval of Quantile Function / Lu Wang (Xi'an Aerospace Propulsion Institute), Ruiyong Zhao, Hongbin Yuan Summary: An improved method for estimating the bootstrap confidence interval of the quantile function is developed, accurately obtaining confidence intervals from very small samples.
- **15:00-15:20** QR2MSE2024-02-0027 A Parametric Approach of Computing Taguchi Signal-To-Noise Ratio from Incomplete Life Data / *Renyan Jiang* (*Wenzhou University*), *Wei Xue, Yu Cao Summary:* This paper proposes a parametric approach, buildsing the life distribution model of each run using a three-step parameter estimation procedure, and the SNR expressions of typical life distributions are derived in this paper.

15:20-15:40 QR2MSE2024-04-0013 Residual Life Prediction Method for Rolling Bearings Considering Random Shock Effect / *Zhe Chen* (*Dalian Jiaotong University*), *Yonghua Li, Denglong Wang, Xuejiao Yin Summary:* A bearing residual life prediction method which considers the effect of random shocks is proposed in this paper.

 15:40-16:00
 QR2MSE2024-04-0027
 Modeling and Wear Analysis of Aircraft Flap Self-Lubricating Bearing / Shuo

 Wang (Shanghai Jiao Tong University), Xianmin Chen, Shichang Du, Shanshan Li, Yiping Shao
 Summary: Taking the actual coupling variable load condition of the self-lubricating bearing as the main

 line, this paper proposes the life prediction model of the aircraft flap self-lubricating bearing.



July 26 [Friday] Special Session C in Function Room 2

14:00-16:00 Digitalization for Safety and Reliability of Nuclear Installations Moderators: Assoc. Prof. Jun Yang, South China University of Technology, China SN ENGR. Baimao Lei, Fifth Electronics Research Institute of Ministry of Industry and Information Technology, China

 14:00-14:20
 QR2MSE2024-01-0066
 Risk-Informed Time Margin Analysis for Operators in Main Control Room of Nuclear Power Plant / *Ting Wen* (Shenzhen University), Leiyue Yang, Anqi Xu, Ming Yang, Chengxiang Liu, Xiaomeng Dong, Linfeng Li

 Summary: This paper proposes a comprehensive framework for analyzing nuclear power plant accidents by integrating risk-informed safety margin characterization with human reliability analysis.

- 14:20-14:40 QR2MSE2024-01-0070 Research on Intelligent Alarm Analysis of Nuclear Power Plant Secondary Loop System Based on Multi-Level Flow Model / Chenxi Zhang (Shenzhen University), Ming Yang, Sijuan Chen, Jianhua Chen, Jipu Wang, Faqiang Qian Summary: In this paper, the application of the multilayer flow model (MFM) is exemplified using the low-pressure feed water heater system of a pressurized water reactor.
- 14:40-15:00 QR2MSE2024-01-0071 Research on the Reasoning Algorithm for Intelligent Alarm Analysis in Nuclear Power Plants Based on Multi-Level Flow Model / Jianhua Chen (Shenzhen University), Sijuan Chen, Ming Yang, Chenxi Zhang, Jinye Guo, Jipu Wang, Chengxiang Liu, Yanjie Guo, Ziyang Luo, Faqiang Qian

Summary: This paper proposes an intelligent alarm algorithm based on multi-level flow mode to significantly improve the safety and operational efficiency of nuclear power plants.

15:00-15:20 QR2MSE2024-02-0029 Review on Potential Application of IOT Technologies in Transporting Radioactive Packages / *Hao Liang* (*Shenzhen University*), *Jipu Wang*, *Yong Liu*, *Sijuan Chen*, *Xu Zhang*, *Chuyang Yu*, *Yuelong Pan*, *Ming Yang*, *Haifeng Qiu*, *Zhenwen Wei*, *Zufeng Cao Summary:* In this paper, the potential application of IoT technologies in transporting radioactive packages are discussed.

15:20-15:40 QR2MSE2024-03-0046 Research on Thermodynamic Features of Transients in the Primary Loop of Nuclear Power Plant / Runze Zhang (Suzhou Nuclear Power Research Institute), Zhilin Chen, Yongqiang Huang
 Summary: In this paper, an automatic classification tool for transient data is developed to realize the automatic identification, classification and management of the whole process of transient statistical work.

15:40-16:00 QR2MSE2024-03-0050 Optimizing the Scale of Off-Site Emergency Decontamination Infrastructure for Nuclear Power Plants: A Case Study / *Hongxing Lu* (*Shenzhen Urban Public Safety and Technology Institute*), *Faming Han, Quanyi Lin, Jinxing Hu, Hudie Huang, Wenlin Wang Summary:* This paper optimizes the scale of off-site emergency decontamination infrastructure for nuclear power plants.



July 26 [Friday] Oral Session C in Function Room 3

14:00-16:00 Probabilistic Modelling of the Degradation in Structures and Systems Moderators: Assoc. Prof. Yan Dong, Harbin Engineering University, Yantai Research Institute, China Assoc. Prof. Xue Zhou, Harbin Institute of Technology, China 14:00-14:20 **QR2MSE2024-01-0018** Accelerated Degradation Modeling and Transfer of Multilayer Ceramic Capacitors / Chensong Ji (Harbin Institute of Technology), Xue Zhou, Mingxu Zhang, Guofu Zhai Summary: This paper proposes a method of accelerated degradation test aiming at the problem of degradation failure of MLCC in industrial production. 14:20-14:40 QR2MSE2024-01-0056 Optimal Burn-In and Warranty Design for Heterogeneous Population Subject to Stochastic Degradation / Xiaoliang Ling (Hebei University of Science and Technology), Dongxu Hu, Yinzhao Wei Summary: A new shock-based burn-in model and analysis of shock influence is established, and a cost model is established, and the optimal magnitude of shock is derived by minimizing the total expected cost. 14:40-15:00 **QR2MSE2024-04-0014** Research on Performance Degradation Assessment of Rolling Bearings / Chaoqun Hu (Dalian Jiaotong University), Yonghua Li, Jiawei Mao, Jiahong Cao Summary: In this paper, a rolling bearing performance degradation assessment method based on Pearson-KPCA combined with HO-SVDD is proposed and experimentally validated. 15:00-15:20 QR2MSE2024-07-0029 Modified Information Criterion for Change-Point Gamma Process Model / Jiahua Qiao (Hebei University of Science and Technology), Xia Cai, Sijia Guo Summary: The paper proposes a modified information criterion (MIC) method for detecting and estimating change points in gamma degradation processes, demonstrating its effectiveness through numerical simulations and application to MOSFET degradation data. 15:20-15:40 QR2MSE2024-04-0064 A Probabilistic Double Linear Damage Accumulation Model for Fatigue Reliability Analysis / Zhaochun Peng (Chaohu University), Jian Hu, Yu Yang, Yu Chen, Yinian Zhang, Qiangqiang Jiang, Jing Wu

Summary: In this paper, a probabilistic double linear damage accumulation model is proposed for the application of fatigue reliability analysis, under lognormal distribution assumption of fatigue life.

15:40-16:00 QR2MSE2024-08-0027 A Modular Petri Net Approach to Reliability Assessment of IOT in Smart Manufacturing Systems / Qin Zhang (University of Electronic Science and Technology of China), Yu Liu, Hong-Zhong Huang Summary: This paper introduces a novel reliability model that comprehensively integrates factors such as the degradation of physical systems and information networks, along with their interactive impacts on system performance and reliability



July 26 [Friday] Oral Session C in VIP Room

- 14:00-16:00 Safety of Waterborne Transportation
- Moderators: Prof. Bing Wu, Wuhan University of Technology, China Prof. Hongshuang Li, Nanjing University of Aeronautics and Astronautics, China
- 14:00-14:20
 QR2MSE2024-01-0014
 Research on Reliability Analysis Method of Stiffened Panel Structure Based on Adaptive Kriging Surrogate Model / Xuejian Hou (Harbin Engineering University), Shili Sun, Zequan Chen, Weilong Miao

 Summary:
 This paper studies the reliability analysis of the stiffened panel structure of an actual offshore platform based on the CIS method
- 14:20-14:40 QR2MSE2024-01-0017 Reliability Analysis of Ship Time Domain Motion Response Based on Fractional Order Moment Maximum Entropy Method / Weilong Miao (Harbin Engineering University), Shili Sun, Zequan Chen, Xuejian Hou Summary: This paper proposes a new method for ship motion response analysis by obtaining the extremal distribution of motion response under certain sea state conditions, which can yield a relatively accurate probability of danger for ship motion response.
- 14:40-15:00 QR2MSE2024-01-0046 Ship Collision Situation Assessment Based on GA-BP and HMM / Erman Zhu (Shanghai Maritime University), Yongtao Xi, Shenping Hu, Xiaolin Mao Summary: A GA-BP and HMM algorithm-based method for evaluating ship collision risk is proposed to enhance water traffic safety by utilizing historical trajectory data and environmental information for accurate and reliable risk assessment.
- **15:00-15:20** QR2MSE2024-01-0050 Characteristics Exploration of Human and Organizational Factors in Maritime Traffic Accidents / *Li Liu* (*Shanghai Maritime University*), *Yongtao Xi, Shenping Hu, Bing Ham, Ziqiang Li Summary:* By analyzing 811 CMSA accident reports using the HFACS model, this study identifies key human and organizational factors causing maritime accidents along the Chinese coast, providing insights for enhancing maritime safety management.
- 15:20-15:40 QR2MSE2024-03-0033 Improved Combinatorial Optimization Model for Vessel Scheduling in Constrained Channel Ports / *Kun Peng (Wuhan University of Technology), Yamin Huang, Linying Chen, Yang Zhou, Liang Huang, Yuanqiao Wen Summary:* In this paper, a systematic solution is proposed to the Multiple Legs and Multiple navigation Modes Vessels Scheduling Problem (ML&MM-VSP) in port region.
- 15:40-16:00
 QR2MSE2024-05-0011
 Design of Anti-Freezing Device Using for Oil Storage Tanks Breathing Valves

 System / Lei Xu (China University of Petroleum), Mingcheng Zhang, Zhenyu Wu, Xiangdong Liu,
 Changyun Li

 Summary:
 A heat-exchanger-based device prevents freezing and blockage of oil storage tank safety

 components by pre-liquefying excessive water vapor in oil and gas through facilitated heat transfer.



July 26 [Friday] Oral Session C in Meeting Room

14:00-16:00 Reliability Analysis and Optimization of Complex Systems and Networks

Moderators: Prof. Yuchang Mo, Huaqiao Univeristy, China Dr. Chaonan Wang, Jinan Univeristy, China

- 14:00-14:20 QR2MSE2024-01-0032 Competing Failure Modeling and Analysis of Phased-Mission Unmanned Aerial Vehicles / Guilin Zhao (Southwest Jiaotong University), Sidi Wang, Lavanya Mandava, Sa Meng Summary: This paper proposes a combinatorial reliability modeling methodology for phased-mission UAVs, addressing dependencies and random isolation times, validated through Monte Carlo simulations.
- **14:20-14:40** QR2MSE2024-02-0030 Failure Analysis and Preventive Maintenance of High-Power Flexible Clutch Systems / *Jiahao Liu* (*Zhengzhou University*), *Jianfeng Yang, Zhiwei Chen Summary:* This paper conducts the failure analysis and preventive maintenance of high-power flexible clutch systems.
- 14:40-15:00 QR2MSE2024-06-0012 A Bi-Level Heuristic Maintenance Scheduling Framework for a Military Aircraft Fleet Under Uncertain Mission Scenarios / *Tiecheng Li* (University of Electronic Science and Technology of China), Chaokun Ma, Long Zhang, Longfei Yue, Qin Zhang, Jun Wu Summary: In this paper, a new maintenance scheduling framework is proposed that aims to maximize the expected operational readiness rate of the military aircraft fleet.
- **15:00-15:20** QR2MSE2024-01-0034 A Reliability Optimization Method of Motion Mechanism Based on Multi-Source Cost Factors / Xu Zhang (Chongqing University), Yan Ran, Nafis J. Sagor, Pengbiao Zhang Summary: This paper proposes a multidimensional reliability cost evaluation system and optimization

model for motion mechanisms, demonstrating effective cost reduction while maintaining design reliability.

- **15:20-15:40** QR2MSE2024-01-0040 A Novel Modelica-Based Reliability Modelling Approach for Electric Propulsion Systems / *Jianyang Fang* (*Harbin Engineering University*), *Jingbo Gai, Xuejiao Du Summary:* This paper introduces a Modelica-based approach to model electric propulsion system reliability, addressing system complexity and demonstrating efficacy via simulation on a specific ship's system.
- **15:40-16:00** QR2MSE2024-01-0043 Reliability Analysis of Multi-State System Considering Interdependent Performance Conversion / *He Lu* (*North China Electric Power University*), *Yan Wang*, *Yu Zhou*, *Heping Jia*

Summary: This paper proposes a model for multi-state systems with interdependent performance conversion and extends the universal generating function (UGF) method for reliability analysis, verified by two numerical examples.



July 26 [Friday] Oral Session D in Function Room 1

16:30-18:30 Reliability Modeling and Risk Analysis

Moderators: Prof. Yonghua Li, Dalian Jiaotong University, China Assoc. Prof. Yongquan Sun, Harbin Institute of Science and Technology, China

 16:30-16:50
 QR2MSE2024-05-0003
 Quality Evaluation for Wind Turbine Design by an Uncertain HOQ / Wanwan

 Zhang (Norwegian University of Science and Technology), Enrico Gliemann, Marco Alborghetti, Victor A.

 Bañuls Ramirez, Giulia Suriano, Marianne Nestle

 Summary: The paper presents an innovative approach to quantifying the quality of wind turbine designs

using uncertainty HoQ, incorporating uncertainty into expert scoring to improve reliability.

16:50-17:10 QR2MSE2024-07-0014 An Improved Uncertainty Calibration Approach for Reliable Satellite Temperature Interval Prediction / Yingchun Xu (National University of Defense Technology), Xiaohu Zheng, Zhiqiang Gong, Yang Xie, Wen Yao Summary: The paper proposes an improved uncertainty calibration method for satellite temperature interval prediction by integrating Mente Carlo Propert and quantile calibration regulation in more credible

interval prediction by integrating Monte Carlo Dropout and quantile calibration, resulting in more credible uncertainty intervals, validated through simulation and real engineering cases.

17:10-17:30 QR2MSE2024-08-0004 Structural Reliability Analysis Method Based on Intelligent Computing / Shunpeng Zhu (University of Electronic Science and Technology of China), Changqi Luo, Yanjing Lv, Xinya You, Mengli Yan Summary: The paper develops efficient and robust structural reliability analysis methods using machine learning and intelligent computing to address high computational costs, low failure probabilities, and high-dimensional nonlinear problems, optimizing strategies for complex structural reliability issues.

- 17:30-17:50 QR2MSE2024-08-0017 The Use of Dynamic Bayesian Model and System Reliability Method for the Structural Health Monitoring of Aircraft Wing / Mengchuang Zhang (Northwestern Polytechnical University), Qin Yao, Zhiping Yin Summary: This article proposes a reliability assessment approach that combines Fault Tree Analysis and Dynamic Bayesian Networks to determine the probabilistic health value of the wing structure
- 17:50-18:10 QR2MSE2024-08-0018 Reliability Analysis of Planetary Roller Screw Mechanism Under Contact Fatigue Failure / Qin Yao (Suzhou University of Science and Technology), Mengchuang Zhang Summary: A global model for the load distribution of PRSM is first established according to deformation coordination relationship and force balance condition, considering uncertainty.
- 18:10-18:30 QR2MSE2024-01-0037 Soil-Structure Reliability Assessment of Fixed Monopile Offshore Wind Turbine Based on Modified Environmental Contour Method / Yan Dong (Harbin Engineering University), Shaofeng Zhong, Jian Zhang, Songxiong Wu, Dandan Yao, Cheng Yee Ng Summary: A reliability assessment method for monopile offshore wind turbines, integrating the modified environmental contour and Monte Carlo methods, is proposed in this study.



July 26 [Friday] Special Session D in Function Room 2

16:30-18:30 Digitalization for Safety and Reliability of Nuclear Installations

Moderators: Assoc. Prof. Jun Yang, South China University of Technology, China SN ENGR. Baimao Lei, Fifth Electronics Research Institute of Ministry of Industry and Information Technology, China

16:30-16:50 QR2MSE2024-04-0034 A Multi-Modal Particle Filtering Method for Fault Detection and Diagnosis of Digital Instrumentation and Control Systems / Jun Yang (South China University of Technology), Baimao Lei, Ke Xue, Bohao Tian
 Summary: A novel multi-modal particle filtering-based method is proposed for fault detection and diagnosis of digital instrumentation and control systems in the paper.

16:50-17:10 QR2MSE2024-04-0051 Deep Learning Based Key Parameters Prediction in Nuclear Power Plants / Jing Cui (Harbin University of Science and Technology), Lei Song, Zhanguo Ma, Huayu Yuan, Wenlin Wang, Wenhao Jia, Long Tian Summary: An improved Non-stationary Transformers (NS Transformer) model is proposed to achieve fast and accurate prediction of parameter trends in NPPs. And the attention mechanism in NS Transformer is improved by the adoption of a sparse attention mechanism.

- 17:10-17:30 QR2MSE2024-06-0010 Research on Standardization of Nuclear Robots / Fugui Liu (Institute for Standardization of Nuclear Industry), Jun Yang, Jijia Zheng, Xueting Ni, Fangfang Dong, Lipo Liu Summary: This paper systematically analyzes the classification, function and development status of nuclear robots at home and abroad.
- 17:30-17:50 QR2MSE2024-03-0048 A Reliability Analysis Method Based on Signed Directed Graph / Xingchen Fang (Anhui Jianzhu University), Dagui Wang, Wenlin Wang, Xinyu Liu, Lei Huang Summary: In this paper, a reliability analysis method based on SDG is proposed to address the lack of quantitative analysis and the large model size.

17:50-18:10 QR2MSE2024-04-0053 An Attempt to Utilize Functional Modeling for Enhanced Application Code Analysis / Zhenwen Wei (Shenzhen University), Jipu Wang, Yunfei Xu, Sijuan Chen, Jin Li, Ming Yang, Hao Liang, Zufeng Cao Summary: This study proposes a function modeling-based analysis method for data anomaly traceback and parameter tuning assistance to deal with the complex and highly coupled relationship among the parameters in the system program.

18:10-18:30 QR2MSE2024-07-0026 Failure Mechanism Analysis and Experimental Study of Tubular Fuses for Nuclear Power Plants / Qiang Chen (China Electronic Product Reliability and Environmental Testing Research Institute), Chenyu Jiang, Baimao Lei, Qian Li Summary: Taking power plant as an example, the failure behavior and energy consumption of power generation system are studied in this paper. Its failure behavior can be divided into two stages, namely normal stage and defective state.



July 26 [Friday] Oral Session D in Function Room 3

16:30-18:30 System Analysis, Simulation and Optimization

Moderators: Prof. Xiaoliang Ling, Hebei University of Science and Technology, China Assoc. Prof. Xuejiao Du, Harbin Engineering University, China

16:30-16:50 QR2MSE2024-01-0077 Stress Response Studies for Urban Steel Gas Pipelines Under Vehicle Loading / Sutong Lv (Chongqing University of Science and Technology), Guihua Liu, Zihao Zhan, Yuanjian Yang

Summary: This paper conducts a stress analysis of urban steel gas pipelines using the pipe earth pressure theory and the distribution angle method.

- 16:50-17:10 QR2MSE2024-01-0078 Evaluation of Emergency Resource Support Capability in Chongqing Metropolitan Area / Yonglong Tang (Chongqing University of Science and Technology), Hao Lu, Hongwei Yin, Yuanjian Yang
 Summary: In this paper, an evaluation index system for the emergency resource support capability of the Chongqing metropolitan area is constructed.
- 17:10-17:30 QR2MSE2024-03-0016 Reliability-Based Design Optimization of Offshore Wind Turbine Support Structure Considering Pile-Soil Coupling Effect / Yizhe Shao (Research Institute of Hunan University in Chongqing, Hunan University), Jie Liu, Zhao Xiao, Fei Ding Summary: This paper introduces a reliability design optimization method for offshore wind turbine support structures, in which the pile-soil coupling and the joint effects of wind and waves are both considered.
- 17:30-17:50 QR2MSE2024-03-0051 Sensitivity Analysis for Optimizing Magnetic Bead Recoveries in a Flow-Through Fluorescence Immunoassay Analyser / *Ziyi Zhao* (University of Electronic Science and Technology of China), Rundan Wei, Le Chang, Zhonglai Wang Summary: An optimal design method for immunoassay analyser based on orthogonal test and sensitivity comprehensive analysis is proposed in this paper.
- 17:50-18:10 QR2MSE2024-04-0055 An Intelligent Cloud Monitoring System for Multiple 3D Printers Based on IOT / Yanzhang Xie (Brunel University London), Qingping Yang, Wenyi Liu, Xizhi Sun Summary: This research developed an IoT-based cloud monitoring system for 3D printers to enhance remote monitoring and control capabilities. And it could collect real-time sensor data on parameters such as temperature and humidity, along with live video feeds.

18:10-18:30 QR2MSE2024-08-0025 Reliability Assessment of Gears Under Multiple Failure Modes in the Transmission System of Offshore Wind Turbine / Chenxu Li (Hohai University), Yuanzhuo Ma, Hongshuang Li, Bofeng Xu, Zhenzhou Zhao Summary: This paper presents a deeply coupling adaptive Kriging-generalized subset simulation (DCAK-GSS) method.



July 26 [Friday] Special Session D in VIP Room

16:30-18:10 Reliability Design and Assessment of Nuclear Power Facilities

- Moderators: Dr. Guozhong Fu, Nuclear Power Institute of China (NPIC), China Dr. Zhe Zhang, Hunan University, China
- 16:30-16:50 QR2MSE2024-11-0001 A Reliability-Based Design Optimization Method by Instance-Based Transfer Learning and the Application of Nuclear Fuel Element Design Optimization / *Zhe Zhang (Hunan University)* Summary: This talk proposes an instance-based transfer learning RBDO method for the design of nuclear fuel elements.
- 16:50-17:10 QR2MSE2024-11-0002 Research on Radiation-Resistant Reinforcement Design Method for Robots Working in Nuclear Environments / *Zhonghua Wang* (*Hunan University*) Summary: This talk aims at developing reinforcement design methods of operating robots suitable for a variety of nuclear radiation scenarios.
- 17:10-17:30 QR2MSE2024-11-0003 Wear Residual Life Prediction of Vulnerable Parts of Control Rod Drive Mechanisms Based on Stochastic Degradation Process and Neural Network / Xiaobo Liu (Nuclear Power Institute of China) Summary: This talk deals with the wear life prediction of wearing parts of control rod drive mechanisms

based on stochastic degradation process and BP neural network, which provides some practical value for wear prediction of nuclear power facilities.

- 17:30-17:50 QR2MSE2024-11-0004 Reliability Assessment of Key Components of Control Rod Drive Mechanisms Based on Digital Prototypes / *Guozhong Fu* (*Nuclear Power Institute of China*) *Summary:* This talk aims at the reliability assessment of the key components of CRDMs Based on the developed digital prototype. The developed lays a theoretical foundation for ensuring the safe and reliable operations of nuclear power facilities.
- 17:50-18:10
 QR2MSE2024-11-0005
 A Physics-Informed Neural Network for Reliability Assessment of CRDMs in Nuclear Power Plants / Tangfan Xiahou (University of Electronic Science and Technology of China)

 Summary:
 This talk aims to provide a physics-informed neural network-based solution for the health status assessment of control rod drive mechanisms in nuclear power facilities.



July 26 [Friday] Oral Session D in Meeting Room

 16:30-18:10 Reliability, Maintainability, and Supportability
 Moderators: Prof. Bo Zheng, Civil Aviation Flight University of China, China Assoc. Prof. Qiang Liu, Guangdong Ocean University, China

16:30-16:50 QR2MSE2024-02-0022 Cost-Based Importance Genetic Algorithm for System Reliability Optimization / Longqiang Liu (Northwestern Polytechnical University), Wenjin Zhu Summary: Combing a cost-based important measure based local search rule and genetic algorithm, this paper proposes a cost importance-based genetic algorithm (CIGA) to improve the efficiency of the cost minimization reliability optimization model.

16:50-17:10 QR2MSE2024-03-0011 Autonomous Underwater Vehicles Hull Shape Resistance Prediction and Multi-Objective Optimization Using CFD / Xinfeng Si (Harbin Engineering University), Yang Ge, Jinxiao Zhu, Wenzhi Liu, Hanqiang Liu, Liming Yu
 Summary: In this article, a parametric Myring shape model is established, and the computational fluid dynamics (CFD) method is used to predict the flight resistance at cruising speed.

17:10-17:30 QR2MSE2024-07-0003 Vibration Mode Analysis of Local Resonance Metamaterial with Chiral Spiral Elastic Beams / *Tan Zeng* (*Northwestern Polytechnical University*), *Hengtai Ni, Chuijian Kong, Jing Liu Summary:* The paper designs a locally resonant metamaterial with chiral helical elastic beams and models and analyzes its vibration modes and bandgap properties to deepen the understanding and optimization of its vibration suppression capability.

17:30-17:50 QR2MSE2024-02-0024 An Integrated Multi-Objective Production Scheduling Approach Considering Mission Reliability / Yuqi Cai (Beijing University of Aeronautics and Astronautics), Jiayang Li, Yihai He, Haibin Cao, Hanjun Guo, Haiyun Lu
 Summary: This paper adopts the mission reliability of the production and transportation system into the scheduling decision-making to propose a more reasonable production scheduling scheme.

17:50-18:10 QR2MSE2024-04-0025 Incremental Learning Based Intelligent Fault Diagnosis of Rolling Bearings / *Matteo Cerea* (Shanghai Jiao Tong University), Lingyun Huang, Francesco Cadini, Siqi Qiu, Xinguo Ming *Summary:* This paper integrates Convolutional Neural Networks (CNNs) with Particle Swarm Optimization (PSO) for Intelligent Failure Diagnosis (IFD) of bearings.



July 27 [Saturday] Oral Session E in Function Room 1

8:30-10:30	Reliability Modeling and Analysis of Complex Systems Considering Imperfect Information and Mixed Uncertainty
Moderators:	Prof. Huanwei Xu, University of Electronic Science and Technology of China, China
	Dr. Lechang Yang, University of Science and Technology Beijing, China

08:30-08:50 QR2MSE2024-01-0073 Reliability Modelling of a Dependent System Using MIC and Pair-Copula / *Xinyao Zhang (University of Science and Technology Beijing), Lechang Yang Summary:* This work proposes a novel approach for the reliability modelling of dependent systems, followed by the development of a new dependency model called MIC-PCC using Pair-Copula.

08:50-09:10 QR2MSE2024-01-0015 T-S Fuzzy Dynamic Fault Tree Analysis Based on Expert Comprehensive Assessment / Qing Xia (Dalian Jiaotong University), Yonghua Li, Lei Gao, Hang Zhang, Kangjun Xu Summary: This paper proposes the T-S fuzzy dynamic fault tree analysis method based on comprehensive expert assessment to enhance the ability of the T-S dynamic fault tree to deal with uncertain events.

09:10-09:30 QR2MSE2024-01-0025 Safety Analysis for Deformable IOT System: A Case Study of Wearable ECG Monitoring System / Qianwen Zhong (Beijing University of Posts and Telecommunications), Rulan Ma, Datian Zhou, Antoine Rauzy Summary: This paper proposes a scenario-based approach, utilizing the AltaRica language innovatively for system modeling and reliability experiments.

09:30-09:50 QR2MSE2024-03-0031 A Multi-Source Information Fusion Method for Multi-Level Performance Index Evaluation / **Dujun Zuo** (Institute of System Engineering, China Academy of Engineering Physics), Zhongming Peng, Chaoyang Xie, Shengbao Luo, Xianjie Shi Summary: In this paper, a multi-source information fusion framework and implementation basis is proposed based on the performance index systems, which includes four steps of collection, quantification, assessment and fusion.

09:50-10:10 QR2MSE2024-01-0072 A Bayesian Network-Based Cream Approach to Human Error Evaluation in Space Station Extravehicular Activities / Chunhao Ma (University of Electronic Science and Technology of China), Xiaopeng Li, Tangfan Xiahou, Shaohua Yang, Yu Liu
 Summary: This paper presents an improved cognitive reliability and error analysis method to assess human error probability during extravehicular activities on space stations.

10:10-10:30 QR2MSE2024-01-0039 Yet Another Least Squares Estimation in NHPP-Based Software Reliability Models with Grouped Data / *Jingchi Wu* (*Hiroshima University*), *Koutaro Daido, Tadashi Dohi, Hiroyuki Okamura*

Summary: This paper considers similar but somewhat different least squares estimation methods for the software reliability analysis.



July 27 [Saturday] Special Session E in Function Room 2

8:30-10:30	Predicting and Optimizing Multi-Objective Reliability of Complex Systems Based on Digital Models and Experiments
Moderators:	Dr. Lanxiang Liu, Harbin Institute of Technology, China Dr. Xiuli Wang, Zhejiang University of Technology, China

08:30-08:50 QR2MSE2024-04-0061 An Improved Generative Adversarial Network for Fault Detection of Bearing / Xiuli Wang (Zhejiang University of Technology), Lingli Li, Zhongxin Li, Yang Li Summary: This article proposes a method based on the Convolutional Wasserstein Conditional Generative Adversarial Network (CW-CGAN).

- **08:50-09:10** QR2MSE2024-05-0006 A Novel Hybrid High-Speed DC Arc Extinguishing Circuit Topology for the Relay / **Yang Zhang** (Harbin Institute of Technology), Wenying Yan, Lanxiang Liu, Fabin Mei, Guofu Zhai Summary: The paper introduces a hybrid DC relay circuit topology, validated by a 28V/40A prototype showing reduced arc energy and improved performance over conventional relays.
- 09:10-09:30 QR2MSE2024-07-0016 Spring Life Prediction Model Based on Stress Relaxation Theory / Wenle Wu (Beijing University of Aeronautics and Astronautics), Chao Zhang, Shaoping Wang, Rentong Chen, Yulong Zhou, Qingxu Liu Summary: The paper develops a spring life prediction model using stress relaxation theory and finite element, offering a method for predicting spring lifespan under various temperatures and loads.

09:30-09:50 QR2MSE2024-07-0017 Analysis of Wear Failure Mechanism and Performance Degradation Prediction of Aviation Fuel Gear Pump / **Yulong Zhou** (*Beihang University*), *Yixing Feng, Chao Zhang, Shaoping Wang, Rentong Chen, Rui Mu Summary:* By analyzing the wear failure mechanism of floating bearings, this study establishes the relationship between wear and leakage, leading to a performance degradation model for aviation fuel gear pumps.

09:50-10:10 QR2MSE2024-06-0004 Research on Integrity Management System and Key Evaluation Technology of Power Station Boiler / **Zhengjia Ma** (*China Jiliang University*), *Zhongping Jin, Xiaomeng Xu, Hong Wang, Qiang Wang, Junzheng Yan Summary:* An integrity management system based on RBI for power plant boilers is proposed, demonstrated through a study of 12Cr1MoV main steam pipelines.

10:10-10:30 QR2MSE2024-03-0034 Structure Eigenfrequency Adjusting Using Topology Optimization with Granular Material Model / Yajin Li (Hebei University of Technology), Haipeng Jia, Jingxuan Dou, Li Dong, Jiaqi Wu
 Summary: In this paper, the parametric level set method is used to optimize the eigenfrequencies and some gap of specified eigenfrequencies of granular material structures.



July 27 [Saturday] Oral Session E in Function Room 3

8:30-10:30 Fault Diagnosis, Prognosis, Condition Monitoring and PHM

Moderators: SN ENGR. Zhaochun Peng, Chaohu Uuniversity, China Prof. Zhonglai Wang, University of Electronic Science and Technology of China, China

08:30-08:50 QR2MSE2024-04-0026 A Multi-Channel Fault Information Bearing Fault Diagnosis Method Based on Improved Vision Transformer / Hongxi Lai (Guangdong Ocean University), Qiang Liu, Zhengwei Dai, Minghao Chen, Peirong Chen, Youlin Liang, Mingxin Hou, Xiaoming Xu, Guangbin Wang Summary: The multichannel signal transformer (MST) model is used to diagnose the bearing faults.

08:50-09:10 QR2MSE2024-04-0044 A Novel Method for Interpretable Bearing Fault Diagnosis Based on Two-Stage Feature Extraction with ZOA-GAF-PCNN-MSA-SVM / Bingfeng Xie (Guangdong Ocean University), Qiang Liu, Peirong Chen, Jinghui Xu, Youlin Liang, Jintai Chen, Zhengwei Dai, Xiaoming Xu, Xiaoyun Shen, Guangbin Wang Summary: This article proposes a new interpretable bearing fault diagnosis method, ZOA-GAF-PCNN-MSA-SVM, which transforms one-dimensional feature sequences into two-dimensional

Gram images through first-stage feature extraction on the original vibration signals.

09:10-09:30 QR2MSE2024-04-0045 Bearing Fault Diagnosis Based on Wavelet Packet Energy Spectrum with Extreme Learning Machine (ELM) / **Youlin Liang** (*Guangdong Ocean University*), *Qiang Liu, Peirong Chen, Bingfeng Xie, Jinghui Xu, Jintai Chen, Hongxi Lai, Xiaoming Xu, Guangbin Wang Summary:* By combining the time domain, frequency domain and wavelet packet energy features of the vibration signal, a PSO-SVM method is proposed to improve the classification accuracy.

09:30-09:50 QR2MSE2024-04-0046 A Novel Method for Rolling Bearing Fault Diagnosis Based on Multi-Domain Feature Extraction and Particle Swarm Algorithm Optimised Support Vector Machine (PSO-SVM) / Peirong Chen (Guangdong Ocean University), Qiang Liu, Bingfeng Xie, Jinghui Xu, Youlin Liang, Jintai Chen, Zhengwei Dai, Xiaoming Xu, Jing Zhang, Guangbin Wang Summary: This paper addresses the bearing failure problem and proposes a bearing fault diagnosis method based on wavelet packet energy spectrum and limit learning machine (ELM).

09:50-10:10 QR2MSE2024-04-0049 Fault Diagnosis Method of Planetary Gearbox Based on Acoustic Signal IACCUGRAM-AMSESHIRD / *Puzhou Wang* (*Jiangxi University of Science and Technology*), *Yejun Li, Xisheng Xiao, Yanghui Lin, Yingkui Gu Summary:* A fault diagnosis method of planetary gear box based on IACCUGRAM and AMSESHIRD is proposed in this paper.

10:10-10:30 QR2MSE2024-04-0071 A Bearing Fault Diagnosis Method Based on VGG SENet-BiGRU GlobalAttention / Minghao Chen (Guangdong Ocean University), Qiang Liu, Hongxi Lai, Zhengwei Dai, Peirong Chen, Youlin Liang, Mingxin Hou, Xiaoming Xu, Guangbin Wang Summary: In this paper, an improved VGG model based on Channel Attention mechanism (SENet) is proposed to extract the spatial features of multi-scale features after fault signal preprocessing.



July 27 [Saturday] Oral Session E in VIP Room

- 8:30-10:10 Intelligent Diagnostics and Prognostics with Sensor Configuration Design for Industrial Systems Moderators: Dr. Xuegian Zhou, Harbin Engineering University, China
 - Dr. Zifei Xu, Liverpool John Moores University, UK
- **08:30-08:50** QR2MSE2024-04-0039 A Novel Remaining Useful Life Prediction Combining IWOA-BiLSTM and PCA for Aircraft Engine / *Guojun Gu* (*Donghua University*), *Di Zhou, Xiaoli Yue, Huimin Chen Summary:* In this paper, a novel RUL prediction method is proposed based on IWOA-BiLSTM and PCA for Aircraft Engine.
- 08:50-09:10 QR2MSE2024-04-0048 Rolling Bearing Fault Diagnosis Method Based on Voiceprint Recognition and FasterNet-CAM / *Puzhou Wang* (*Jiangxi College of Applied Technology*), *Yanghui Lin, Yejun Li, Yin Li, Yingkui Gu Summary:* In this paper, a rolling bearing fault diagnosis method based on voiceprint recognition is proposed.
- 09:10-09:30 QR2MSE2024-04-0066 A Review of Order-Ratio-Based Fault Feature Extraction Techniques for Planetary Gearboxes / Yanyan Liu (University of Science and Technology Beijing), Tongxin Gao, Dayi Wang, Wenxu Wu Summary: This paper analyses the advantages and disadvantages of signal processing methods based

on order-ratio analysis and this study looks forward to the future development and challenges in the field of fault diagnosis of planetary gearboxes.

09:30-09:50 QR2MSE2024-04-0050 A Pattern Recognition Method Using Big Data for Device Behaviour with Linear Features / Zhong Han (Anshan Normal University), Hua Shen, Zefeng Wang, Qiang Han, Qirong Zhang, Li Feng, Yayun Wang Summary: The paper proposes a big data driven pattern recognition method utilizing linear features to

Summary: The paper proposes a big data-driven pattern recognition method utilizing linear features to accurately identify and monitor device behavior, ensuring their normal operation by constructing sequence data, preprocessing, cleaning, and analyzing device state changes, culminating in effective graphical simulations and validations of the proposed method.

09:50-10:10 QR2MSE2024-04-0062 An Intelligent Fault Diagnosis of Drilling Pumps Using WCCN-Transformer with Multi-Source Signals / Junyu Guo (Southwest Petroleum University), Yulai Yang, Zhiyuan Wang Summary: This paper proposes a novel method namely WCCN-Transformer for intelligent fault diagnosis of drilling pumps and an accurate fault diagnosis of a real five-cylinder drilling pump is carried out.



July 27 [Saturday] Oral Session E in Meeting Room

8:30-10:10 Reliability Modeling and Risk Analysis

- Moderators: Assoc. Prof. Xiaohong Hao, University of Electronic Science and Technology of China, China Dr. Ying Zeng, University of Electronic Science and Technology of China, China
- 08:30-08:50 QR2MSE2024-01-0076 Fatigue Finite Element Analysis and Risk Measures of Urban Steel Gas Pipelines Under Vehicle Loads / Youjian Gu (Chongqing University of Science and Technology), Chengyuan Ma, Guo Huan, Yuanjian Yang Summary: This paper conducts the fatigue reliability and risk measures of urban steel gas pipelines under vehicle loading.
- 08:50-09:10 QR2MSE2024-01-0081 Analysis of Key Dynamic Parameters for Typical Scenarios of SLOCA Based on RISMC Method / Churan Feng (China Nuclear Power Engineering Co., LTD.), Guoqiang Zhang, Jinlong Sun, Jingxiang Zhan
 Summary: This paper analyzes and obtains the scenarios with higher risks in the small loss of coolant accidents.
- 09:10-09:30 QR2MSE2024-06-0005 Explosion Hazard Analysis of LNG Tank Trucks Passing Through Cross Sea Bridges After Unloading / *Guide Deng* (*China Special Equipment Inspection & Research Institute*), Zheng Fang, Xiaolian Guo, Zhongqiang Liu, Lijing Mu Summary: Considering the small amount of the filled medium, this paper conducts research on whether the LNG tank trucks can safely pass across bay bridges after unloading.
- 09:30-09:50 QR2MSE2024-01-0047 Reliability Analysis of Ultimate Strength of FPSO Based on Maximum Entropy Method / Tenglong Jin (Harbin Engineering University), Chenfeng Li, Zequan Chen, Houyao Zhang

Summary: This paper introduces a risk-based framework for evaluating the ultimate strength safety of FPSO hull girder based on maximum entropy method.

09:50-10:10 QR2MSE2024-01-0074 Enhancing Emotion Recognition with Attention-Augmented EEG Models / *Yuxiang Zeng* (Shenzhen University), Hongyuan Cui, Chengxiang Liu, Shubing Li, Anqi Xu, Kunze Yang *Summary:* This study demonstrates the incorporation of attention-enhanced convolutional networks into a graph-based multitasking self-supervised learning model for EEG-based emotion recognition in a nuclear power environment.



VII. Conference Information

A. Conference Floor



The 1st Floor of Wanda Vista Harbin

B. Registration

Role	Page Charges	Deadlines	
Regular	500USD		
Student	300USD	On or Before May 31, 2024	
Regular	650USD	June 1, 2024 – June 30, 2024	
Student	450USD		
Regular	800USD		
Student	600USD	After July 1, 2024	

The regular registration fee includes all keynote speeches and technical sessions, lunch, the banquet, and souvenirs. For student registration, souvenirs are not included.



C. Transportation

China, No. 87 Shimao Avenue, Songbei District, Harbin, Heilongjiang, (At the red mark in the picture)





Access to Wanda Vista Harbin

From Harbin Taiping International Airport



Harbin Taiping International Airport



Wanda Vista Harbin

Recommended routes:

By taxi: about ¥ 105 (including toll), 34 minutes.

From Harbin Railway Station



18km



Wanda Vista Harbin

Harbin West Railway Station

Recommended routes:

1. \bigotimes By taxi: about 45, 28 minutes.

2. **W** By bus: about ¥ 3, 62 minutes.

Bus Stop **"Harbin West Station East Square"** - Bus New District Line 6 - Bus Stop **"Wanda Vista Hotel"** (19 stops). Operation time: 06:10—19:10.



From Harbin West Railway Station



18km



Harbin West Railway Station

Wanda Vista Harbin

Recommended routes:

1. \bigotimes By taxi: about \cong 45, 28 minutes.

2. **W** By bus: about ¥ 3, 62 minutes.

Bus Stop **"Harbin West Station East Square"** - Bus New District Line 6 - Bus Stop **"Wanda Vista Hotel"** (19 stops). Operation time: 06:10—19:10.

Contact information of conference secretariat

On-site helpers and volunteers at Harbin Taiping International Airport, Harbin Railway Station and Harbin West Railway Station are as follows.

Mr. Kanglu Pang	+86 183 3525 7988	Harbin Taiping International Airport
Mr. Shuai Liu	+86 183 3646 0879	Harbin Railway Station
Mr. Minghao Chu	+86 178 8221 5279	Harbin West Railway Station

* Please do contact the conference secretariat if you need any help on transportation.



D. General Information

About Harbin

Harbin is the capital city of Heilongjiang province, located in Northeast China, an important tourism and commercial city in China. Harbin is the political, economic and cultural center in the north of Northeast China, known as the Pearl of the Eurasian Continental Bridge, the first Eurasian Continental Bridge and the air corridor of the international comprehensive transportation hub, the starting point of the industrial corridor of Harbin-Daqi, the national strategic positioning of the development and opening up of coastal cities, the Northeast Asian regional center and the "center of cooperation with Russia".

Harbin is a national historical and cultural city, but also internationally renowned ice and snow culture and ice and snow tourism city, known as the "Oriental Moscow" and "Oriental small Paris". Harbin is also a national civilized city, an international wetland city, the cultural capital of East Asia and one of the top ten ice and snow tourism cities in China and has been awarded the title of "City of Music" by the United Nations.





About Tourism

Central Avenue (中央大街)

Central Avenue was built in 1898, starting from the Songhua River Flood Control Memorial Tower in the north to Jingwei Street in the south. There are 71 European-style and imitation European-style buildings on the street, and 13 municipal-level protected buildings of Renaissance, Baroque, eclectic and modern styles, and it became the first commercial pedestrian street in China on 1 June 1997, and was awarded the "China Habitat Environment Example Prize" by the Ministry of Construction in 2005, and in March 2008, the Central Avenue of Harbin, the Little Paris of the East, was awarded the "United Nations Architectural Achievement Award" by the United Nations. At the same time, the Central Avenue of Harbin was awarded the title of "Museum of Architecture and Art" by the State. 2009, the Central Avenue was awarded the first batch of Famous Historical and Cultural Streets of China.





Saint Sophia Cathedral (圣·索菲亚教堂)

Saint Sophia Cathedral located at No. 59, Turbine Street, Daoli District, Harbin, is a typical Byzantine Orthodox church designed by the Russian architect Koyasikov. The whole church for the court-style architecture, the center of a main building has a standard vault, red monument structure, lofty and spacious. The height of 53.35 meters, covers an area of 721 square meters. Saint Sophia Cathedral was built in March 1907 as a church for the troops of the 4th Infantry Division in Eastern Siberia. In the same year, funded by the Russian tea merchants, the church was rebuilt on the basis of the military church into an all-wooden structure, and in 1932 it was rebuilt to become the largest Orthodox church in the Far East. The church has a rich exotic atmosphere, become a unique landscape in Harbin, is the historical witness and important relics of the Russian invasion of the Northeast. It is the fourth batch of national key cultural relics protection units and is now the Harbin City Architecture and Art Museum.





Harbin Grand Theatre (哈尔滨大剧院)

Harbin Grand Theatre is located in the cultural center island of Songbei District, Harbin, including the Grand Theatre (1600 seats) and the Small Theatre (400 seats), the building adopts the shape design of heterogeneous hyperboloid, and it is the iconic building in Harbin. In February 2016, the Harbin Grand Theatre was selected by ArchDaily as the "World's Best Buildings 2015" in the "Best Cultural Building" category. Harbin Grand Theatre is built by the water, consistent with the positioning and design of Harbin Cultural Island, reflecting the design concept of the northern landscape. As a public building facility, the Harbin Grand Theatre seeks to provide different spatial feelings to the public and visitors from the theatre, landscape, plaza and three-dimensional platform. The theatre has set up a unique pedestrian sightseeing corridor and a viewing platform, where visitors can overlook the surrounding wetlands and enjoy the unique natural wetland scenery of Harbin.





Sun Island (太阳岛风景区)

Sun Island is rare in China is located in the city center of the river wetlands, grassland-type ecological zones along the river, it belongs to Harbin a beautiful tourism card. But what is less known is that it is also a "three in a row" Harbin city card. In 2006 by the United Nations Friendship Council awarded the United Nations ecological model island of the honorable title, the same year Sun Island Scenic Area by the Ministry of Construction of the People's Republic of China awarded the "China Habitat Environment Example Award", in 2007 was assessed as the first batch of national 5A-level tourist attractions, while the Sun Island was also awarded the National Scenic Spot, National Water Resources Scenic Spot, National Cultural Industries Demonstration Site and other honors. Sun Island is located in the north bank of the Songhua River, Jiangnan District and Songbei District, a total area of 88 square kilometers, the scenic area of 38 square kilometers of planning area, the peripheral protection area of 50 square kilometers, north and south of the Songhua River and the forward dike to the boundary of the rewire, the east of Binzhou Railway Bridge, the west to the Fourth Ring Viaduct, a larger area is divided into three areas of the east and west, the eastern part of the core landscape area, but also tourists focused on the area of the viewing, the middle area of culture and leisure areas, represented by the polar museum science and technology museum, Moon Bay TV City. West for the natural ecological area, on behalf of the Ice World, a lake and three islands, Sun Island is a set of continental style, countryside scenery, Northeast folklore, ice and snow culture set into one of the multi-functional landscape area.

