

Efficient Reliability Analysis of Complex Systems



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Abstract

Engineered systems are critical for the functionality of our economic and societal life, they are the technical backbone of our society. A key requirement is, thus, to ensure their reliable performance. Reliability and performance analysis, however, become increasingly complicated due to uncertainties and complexity. In our developed societies, engineered systems are characterized by a rapid growth in scale and complexity. The amount of information needed to model these systems with their complexity is, thus, growing as well. In contrast to this increasing need for information the available information remains almost at the same level. Hence, with increasing scale and complexity the gap between required and available information is growing quickly, so that uncertainties and risks are involved in our models and analyses to a greater extent than ever before. This seminar will highlight selected approaches to address this challenge. Concepts for dealing with epistemic and hybrid uncertainties are discussed, including applications to systems reliability assessment. In order for numerical efficiency to deal with complex systems, survival signature is presented as powerful systems model in combination with advanced simulation technologies for performance and reliability assessment. Novel pathways to capture interdependencies between systems are discussed. Engineering examples are presented to demonstrate the capabilities of the approaches and concepts.

About the Speaker

Michael Beer is Professor and Head of the Institute for Risk and Reliability, Leibniz Universität Hannover, Germany. He is also part time Professor at the University of Liverpool and guest Professor at Tongji University and Tsinghua University, China. He obtained a doctoral degree from Technical University Dresden, Germany, and worked for Rice University, National University of Singapore, and the University of Liverpool, UK. Dr. Beer's research is focused on uncertainty quantification in engineering with emphasis on imprecise probabilities. Dr. Beer is Editor in Chief of the ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A Civil Engineering and Part B Mechanical Engineering. He is also Editor in Chief (joint) of the Encyclopedia of Earthquake Engineering, and Associate Editor of Information Sciences. He has won several awards including the Alfredo Ang Award on Risk Analysis and Management of Civil Infrastructure of ASCE. Dr. Beer is the Chairman of the European Safety and Reliability Association (ESRA) and a Co-Chair of Risk and Resilience Measurements Committee (RRMC), Infrastructure Resilience Division (IRD), ASCE. He is serving on the Executive Board of the International Safety and Reliability Association (IASSAR), on the Executive Board of the European Association of Structural Dynamics (EASD), and on the Board of Directors of the International Association for Probabilistic Safety Assessment and Management (IAPSAM). He is a Fellow of the Alexander von Humboldt-Foundation and a Member of ASCE (EMI), ASME, CERRA, IACM and GACM.