Preface

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Biographical notes: Michael Beer is Professor and Chair in the Centre for Engineering Sustainability, School of Engineering, University of Liverpool. He graduated with a doctoral degree in Civil Engineering from the Technische Universität Dresden, Germany. As a Feodor-Lynen Fellow of the Alexander von Humboldt-Foundation he pursued research at Rice University together with Professor Pol D. Spanos. From 2007 to 2011 he worked as an Assistant Professor in the Department of Civil & Environmental Engineering, National University of Singapore. His research is focused on non-traditional uncertainty models in engineering with emphasis on reliability analysis and on robust design.

Rafi L. Muhanna is an Associate Professor and the Director of Center for Reliable Engineering Computing at Georgia Institute of Technology. He received his PhD from the Higher Institute for Structure and Architecture, Sofia, Bulgaria. His research is in the general area of computational solid and structural mechanics that includes uncertainty modelling, structural reliability, computational reliability. He won a number of international prizes, among them: the Aga Khan Award for Architecture (1992); the Golden Prize of the World Intellectual Property Organization (WIPO) and the Special Prize of the United Nations HABITAT (1989). He is member of ASCE, ASME, and ASEE.

Robert L. Mullen is Professor and Chair of the Department of Civil and Environmental Engineering at the University of South Carolina. Prior to joining the faculty at South Carolina, he was the Frank Neff Professor and

Chair of the Civil Engineering Department at Case Western Reserve University. He received his PhD in Applied Mechanics from Northwestern University, under Ted Belytschko. He is currently the Co-Director of the Centre for Reliable Engineering Computing at Georgia Institute of Technology. He is a Fellow of the American Society of Civil Engineers and a member of the American Society of Mechanical Engineers.

This special issue is focused on Robust Design in a broad sense in the context of hazards, risk and uncertainty. It is based on the 4th International Workshop on Reliable Engineering Computing, held in Singapore, 3–5 March 2010 (REC2010). Particular emphasis is on a multi-disciplinary character to form a unique symbiosis of various engineering and associated disciplines within the kernel areas of engineering, computer science, sciences, and mathematics. The contributions are distributed over two consecutive journal issues.

The issue of robustness has attracted increasing attention. Societal and industrial interest has grown from both a safety point of view and an economic point of view. The development is driven by a series of accidents with natural and manmade sources, including inappropriate design, as well as by changing economic and environmental requirements and conditions including effects from climate change. Robust design has to ensure that our engineering systems can cope with all hazards, risk and uncertainty over their entire lifetime from the construction to the controlled demolition. The potential for applications ranges over all engineering fields. The developments in robust design are characterised by a remarkable diversity and high complexity, which concerns (a) the definition of robustness, (b) the mathematical framework, and (c) the application field. Included is the design of structures, systems, processes, operations, new materials and technologies, computational procedures, numerical models, hardware components, etc. The modelling of hazards, risk and uncertainty is frequently associated with subjective, rare and imprecise information. Appropriate mathematical models are required for the treatment of aleatory and epistemic uncertainty and for imprecision and indeterminacy. Proposals for solutions include well-developed and established traditional stochastic methods such as reliability-based design and performance-based design, as well as a variety of non-traditional methods based on Bayesian theory, interval analysis, fuzzy set theory, evidence theory, imprecise probabilities, p-box approach, fuzzy probability theory, etc. In this context it is aimed at reliable and efficient numerical models and methods for robust design and associated problems.

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