Forward

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Biographical notes: Dr. Zissimos P. Mourelatos is an Associate Professor of Mechanical Engineering at Oakland University. He conducts research in the general areas of structural dynamics and reliability methods in engineering design. Before joining Oakland University, he spent 18 years at the General Motors Research and Development (GM R&D) Center and was concurrently an Adjunct Associate Professor at The University of Michigan for 17 years. He received his PhD in 1985 from The University of Michigan. He is active in the dynamics and vibrations as well as structural reliability communities, including membership in SAE, ASME and AIAA. His research interests include internal combustion engine dynamics, NVH (Noise, Vibration and Harshness), design under uncertainty, structural reliability methods, reliability analysis with insufficient data, response surface generation and Reliability-Based Design Optimisation (RBDO). He is the Editor-in-Chief of the newly established *International Journal of Reliability and Safety*.

In today's competitive automotive business environment, decisions on product design and development involve significant uncertainty. It is therefore, important to replace the traditional deterministic way of thinking with a new non-deterministic decision-making approach. Automotive manufacturers can greatly improve the performance, safety and cost of their products, using principles of reliability and robust design, accounting for the uncertainty and the risk of failure in a rigorous way. Reliability and robust design is becoming increasingly popular in the automotive industry. Companies need to educate their designers, engineers and managers on the advantages and the potential of reliability analysis and design. On the other hand, professors need to educate their students in non-deterministic methods and increase the awareness of administrators on the importance and potential of these approaches.

The current competitive automotive market environment calls for high quality vehicles in the presence of uncertainty in customer expectations, manufacturing tolerances and operating conditions. The customers demand optimised, reliable, and robust products. A product is reliable if it meets performance targets in the presence of uncertainty and robust if performance variation is minimised without eliminating the causes of variation. Although the importance of reliable and robust design has been recognised in the automotive industry, the high computational cost associated with it hinders its wide use by the automotive designers. To address the high computational cost, associated with reliability and robust design assessment of complex automotive systems, the engineering community very often relies on meta-models, or response surface models, as surrogates of the computationally demanding CAE models. Fast-running

meta-models are usually developed to approximate the CAE model's input-output relationships from a set of pre-generated CAE simulations. Accurate meta-model generation is therefore, very important in reliability-based and robust design of large-scale automotive applications.

This special issue presents a collection of papers mainly on reliability-based and robust design with emphasis on automotive applications. It includes papers authored by academicians as well as managers and engineers from the automotive industry. The covered subjects include, among others, reliability-based design of automotive systems, fatigue reliability, model validation and verification, reliability testing, response surface generation (meta-modelling) and their use in reliability assessment, and non-probabilistic methods for uncertainty quantification.

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