Dealing with Vague and Limited Information in Uncertainty Quantification

M. Beer[1)3)4)], **I. A. Kougioumtzoglou**[2)], **E. Patelli**[3)] and **M. Broggi**[1)]

[1)]Institute for Computer Science in Civil Engineering, Leibniz University Hannover, 30167 Hannover, Germany, {beer, broggi}@bauinf.uni-hannover.de

[2)]Department of Civil Engineering and Engineering Mechanics, Columbia University, New York NY 10027, USA, ikougioum@columbia.edu

[3)]Institute for Risk and Uncertainty, University of Liverpool, Liverpool L69 7ZF, United Kingdom, epatelli@liverpool.ac.uk

[4)]School of Civil Engineering & Shanghai Institute of Disaster Prevention and Relief, Tongji University, Shanghai 200092, China

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Abstract

Developed societies rely increasingly on systems and infrastructure with a rapidly growing complexity. This complexity and our environment are associated with uncertainties to a greater extent than ever before, specifically characterized by vague and limited information. In order to cope with this challenge, potent concepts and approaches for uncertainty quantification including analytical and numerical techniques are developed. The overall goal of these developments is a realistic and efficient treatment of uncertainties in a comprehensive manner in order to derive optimal decisions. In this context we discuss selected emerging concepts and approaches in three directions with focus on how to deal with vague and limited information. First, new pathways in advanced stochastic modeling are considered to capture the physics of the underlying problem in conjunction with efficient approximate representations and solution methodologies. Second, advancements in generalized uncertainty modeling with new features for characterizing vague information are presented. Third, selected potent Monte Carlo techniques and new directions for numerically efficient simulation are discussed. Examples from engineering are shown to demonstrate the capabilities of the concepts discussed.

References

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