

# Emerging Concepts and Approaches for Efficient and Realistic Uncertainty Quantification \*

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**Abstract:** Our built environment is increasingly dominated by structures and infrastructure from previous decades, partly even with a century of experienced lifetime. These structures and infrastructure are, to a significant extent, critical for the functionality of our economic and societal life, and thus, require proper approaches and measures to verify and ensure their safety. Safety analysis and maintenance scheduling, however, become increasingly complicated due to uncertainties and complexity, which result significantly from ageing and from interactive phenomena. The realistic quantification of uncertainties and their numerically efficient processing in complex analyses are the two key challenges in this context. In this Chapter we discuss emerging concepts and approaches which address these challenges in three directions.

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\* From: M. Beer, I.A. Kougoumtzoglou and E. Patelli. Emerging Concepts and Approaches for Efficient and Realistic Uncertainty Quantification. In: Maintenance and Safety of Aging Infrastructure: Structures and Infrastructures Book Series, Vol. 10, D. Frangopol, Y. Tsompanakis (eds.), pp. 121–161, 2014, CRC Press/Balkema. For full text please check DOI: 10.1201/b17073-6, Reproduced in the printed Proceedings by permission of Taylor & Francis Books UK.

