Reliability Analysis And Rare Event Simulation

5000 Scientific Computing

Max Ehre\*, Iason Papaioannou\*, Edoardo Patelli†, Daniel Straub\* And Bruno Sudret ‡

\* Technichal University of Munich, Engineering Risk Analysis Group

Theresienstraße 90, 80290 Munich

max.ehre@tum.de, [iason.papaioannou@tum.de](mailto:iason.papaioannou@tum.de), straub@tum.de

† Centre for Intelligent Infrastructure, Department of Civil and Environmental Engineering, University of Strathclyde

16 Richmond St, Glasgow G1 1XQ

edoardo.patelli@strath.ac.uk

‡ETH Zürich, Chair of Risk, Safety and Uncertainty Quantification

Stefano-Franscini-Platz 5, 8092 Zurich

sudret@ethz.ch

**Key words:** Reliability analysis, rare event simulation, RBDO, reliability sensitivity, Bayesian reliability updating

ABSTRACT

Model-based quantification of the probability of failure is essential for development, design and assessment of engineering systems. Challenges in computing the probability of failure are associated with non-linear system behaviour, large numbers of uncertain parameters and failure/rare events inducing multiple, disconnected failure domains. We invite talks discussing efficient computational methods for simulating rare events and quantifying failure probabilities based on sampling, surrogate modelling and machine learning as well as approximation approaches. Relevant applications of these techniques are in assessment of static and dynamical engineering systems, reliability-based design optimization and reliability-oriented sensitivity analysis of such systems as well as Bayesian updating of failure probabilities.