14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19–24, 2020, Paris, France

MACHINE LEARNING AND SURROGATE MODELLING APPROACHES FOR UNCERTAINTY QUANTIFICATION, RELIABILITY ANALYSIS AND DESIGN OPTIMIZATION TRACK NUMBER 800

Matthias Faes*, Stefano Marelli†, Bruno Sudret†, Jean-Marc Bourinet+ and Enrico Zio‡

* KU Leuven
Jan De Nayerlaan 5, BE-2860 St.-Katelijne-Waver
matthias.faes@kuleuven.be

† ETH Zurich
Stefano-Franscini-Platz 5
(marelli,sudret)@ibk.baug.ethz.ch

+ Sigma-Clermont
4 Avenue Blaise Pascal, FR-63187 Aubière Cedex
jean-marc.bourinet@sigma-clermont.fr

‡ Politecnico di Milano
Via La Masa 34, IT-20156 Milan
enrico.zio@polimi.it

Key words: Uncertainty quantification, machine learning, surrogate modelling

ABSTRACT

The safe and reliable design of engineering structures and systems, as well as the online assessment of their reliability and safety depends largely on high resolution numerical models that approximate their physical behaviour. However, these high resolution results often come at an undesirably high computational cost, as solving these models for relevant responses sometimes takes hours or even days. In the context of uncertainty quantification, reliability analysis and design optimization, these models have to be solved multiple times in an often iterative context. This impedes their application in a reliability engineering context, unless high-performance computing facilities are readily available. Both machine learning approaches, as well as surrogate modelling techniques can provide a solution to this problem by respectively representing the physical system following a data-driven black box approach, and constructing a more efficient emulator of the real numerical model.

This mini-symposium is aimed at gathering experts researchers, academics and practicing engineers concerned with the efficient combination of computationally intensive numerical simulation codes with efficient surrogate models and/or data-driven black box approaches to present their recent findings, methodological developments, as well as innovative applications.