6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

MULTI-OBJECTIVE RELIABILITY BASED DESIGN OF COMPLEX ENGINEERING STRUCTURES USING RESPONSE SURFACE METHODS

Luis Celorrio*[1] and Edoardo Patelli[2]

[1] University of La Rioja, Deparment of Mechanical Engineering, University of La Rioja.
C/ San José de Calasanz, 31, 26004 Logroño, Spain. luis.celorrio@unirioja.es www.unirioja.es

[2] Institute for Risk and Reliability, University of Liverpool
Chadwick Building, Peach Sreet, Liverpool, United Kingdom,
edoardo.patelli@liverpool.ac.uk www.liverpool.ac.uk

Key Words: *Multi-objective optimization under uncertainty; response surface methods, Decision Maker; OpenCOSSAN.*

Extensive research contributions have been carried out in the field of Reliability-Based Design Optimisation (RBDO). Traditional RBDO methods deal with a single objective optimisation problem subject to probabilistic constraints. However, realistic problems in engineering practice require a multi-criteria perspective where two or more conflicting objectives need to be optimised. These type of problems are solved with multi-objective optimization methods, known as Multi-Objective Reliability Based Design Optimization (MORBDO) methods. Usually, significant computational efforts are required to solve these types of problems due to the huge number of complex finite element model evaluations. This paper proposes a practical and efficient approach based for talking this challenge. A multiobjective evolutionary algorithms (MOEAs) is combined with response surface method to obtain efficiently, accurate and uniformly distributed Pareto front. The proposed approach has been implemented into the OpenCossan software. Two examples are presented to show the applicability of the approach: an analytical problem where one of the objectives is the system reliability and the classic 25 bars transmission tower.

REFERENCES

[1] E. Patelli, COSSAN: A Multidisciplinary Software Suite for Uncertainty Quantification and Risk Management. *Handbook of Uncertainty Quantification*, 1-69. Springer International Publishing. 2015.

[2] Patelli, E.; Tolo, S.; George-Williams, H.; Sadeghi, J.; Rocchetta, R.; Angelis, M. D. & Broggi, M. OpenCossan 2.0: an efficient computational toolbox for risk, reliability and resilience analysis. Proceedings of the joint ICVRAM ISUMA UNCERTAINTIES conference, 2018

[3] Celorrio L. (2017) Multiobjective Reliability-Based Design Optimization Formulations Solved Combining NSGA-II and First Order Reliability Method. In: Martínez de Pisón F., Urraca R., Quintián H., Corchado E. (eds) Hybrid Artificial Intelligent Systems. HAIS 2017. Lecture Notes in Computer Science, vol 10334. Springer, Cham. (2017).