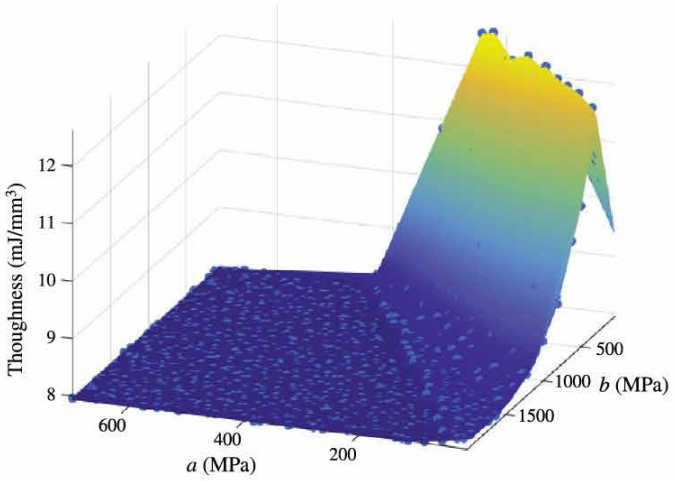
DATA-DRIVEN DESIGN OF NEW MATERIALS AND STRUCTURES

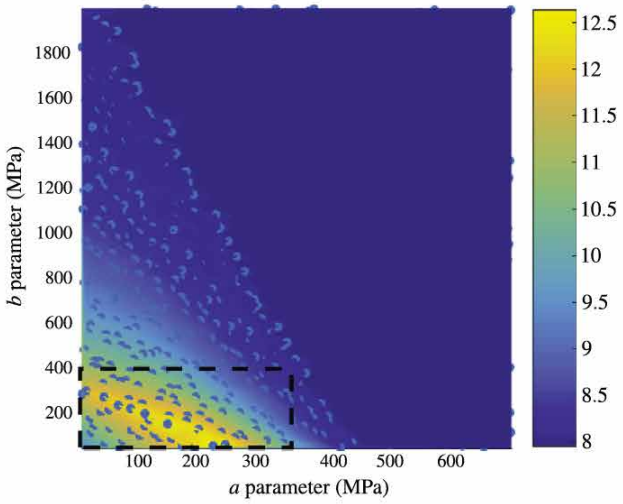
Prof. Miguel A. Bessa

(TU Delft , The Netherlands)

16.08.2018 –
15:00 – IC 6/156



(a) Response surface of composite toughness ($k_1 = 64$).



(b) Contour plot of composite toughness ($k_1 = 64$).

A data-driven computational framework [1, 2] combining Bayesian machine learning for imperfection sensitive quantities of interest, uncertainty quantification and multi-objective optimization is developed to analyze and design new materials and structures. This talk intends to demonstrate the generality of the proposed framework, highlighting key challenges and possible solutions illustrated by three different design problems: toughening composite materials by tuning the plastic behavior of the constituents, improving collapse behavior of ultra-thin satellite structures with uncertain ultimate buckling strength, and finding unprecedented properties by exploring a new material concept.

References

[1] Bessa, M. A. et al. (2017). A framework for data-driven analysis of materials under uncertainty: Countering the curse of dimensionality. Computer Methods in Applied Mechanics and Engineering, 320, 633-667.

[2] Bessa, M. A., & Pellegrino, S. (2018). Design of ultra-thin shell structures in the stochastic post-buckling range using Bayesian machine learning and optimization. International Journal of Solids and Structures, 139, 174-188.

Guests are welcome!