Accepted Manuscript

Identification and quantification of multivariate interval uncertainty in finite element models

M. Faes, J. Cerneels, D. Vandepitte, D. Moens

PII: S0045-7825(16)30744-7
DOI: http://dx.doi.org/10.1016/j.cma.2016.11.023
Reference: CMA 11233

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 14 July 2016
Revised date: 6 November 2016
Accepted date: 18 November 2016

Please cite this article as: M. Faes, J. Cerneels, D. Vandepitte, D. Moens, Identification and quantification of multivariate interval uncertainty in finite element models, *Comput. Methods Appl. Mech. Engrg.* (2016), http://dx.doi.org/10.1016/j.cma.2016.11.023

Identification and quantification of multivariate interval uncertainty in Finite Element models

M. Faes[a], J. Cerneels[a], D. Vandepitte[b,c], D. Moens[a]

[a] *KU Leuven, Department of Mechanical Engineering, Technology Campus De Nayer, Jan De Nayerlaan 5, B-2860 St.-Katelijne-Waver*
[b] *KU Leuven, Department of Mechanical Engineering, Campus Heverlee, Celestijnenlaan 300, B-3001 Leuven*
[c] *Member of Flanders Make*

Abstract

The objective of this work is to develop and validate a methodology for the identification and quantification of multivariate interval uncertainty in finite element models. The principal idea is to find a solution to an inverse problem, where the variability on the output side of the model is known from measurement data, but the multivariate uncertainty on the input parameters is unknown. For this purpose, the uncertain simulation results set created by propagating interval uncertainty through the model is represented by its convex hull. The same concept is used to model the uncertainty in the measurements. A metric to describe the discrepancy between these convex hulls is defined based on the difference between their volumes and their mutual intersection. By minimisation of this metric, the interval uncertainty on the input side of the model is identified. It is further shown how the procedure can be optimized with respect to output quantity selection. Validation of the methodology is done using simulated measurement data in two case studies. Numerically exact identification of multiple, coupled parameters having interval uncertainty is possible following the proposed methodology.