Quantification of interval field uncertainty in numerical models

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In the context of integrating uncertainty and variability in Finite Element (FE) models, several advanced techniques for taking both inter- and intra-variability into account have been introduced in literature. In the framework of building possibilistic models for the representation of intra-variability, especially the theory of interval fields (IF) has proven to show promising results. Following this approach, non-determinism in the input parameters of the FE model is introduced as the superposition of a number of base vectors scaled by interval factors. In this formulation, the spatial component of the uncertain parameter is modelled solely by the base vectors, whereas the magnitude of the uncertainty is captured in the independent interval scalars. Application of the IF concept to real life problems however requires the identification of these parameters based on experimental data. So far, research has mainly focused on the identification of interval uncertainty for the case of inter-variability.

This PhD study focusses on the identification and quantification of interval field uncertainty, based on variability in a set of indirect measurements. Specifically, the interval field uncertainty that an analyst faces on the input parameters of a numerical model is identified, based on measurements of the responses of that model in real life. The identification and quantification is achieved by mapping the convex hull over the realised responses of the interval field numerical model to the set of measurement data in an iterative procedure. The identification of the base vectors is analogously performed, where the information of the constituting base vectors is derived from the gradients of the convex hull of the measurement set. Very accurate results are obtained by the proposed methodology.

Speaker bio: Matthias Faes

Matthias Faes is a final year PhD-student at KU Leuven, working under supervision of prof. dr. ir. David Moens. The topic of his research is the development and validation of novel techniques for the identification and quantification of multivariate and non-homogeneous interval uncertainty in the context of numerical design models. He graduated in 2013 *summa cum laude* as M.Sc. in Engineering Technology and is since then full-time PhD Student at KU Leuven.