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

REDUCING THE EXPERIMENTAL EFFORTS TO IDENTIFY MATERIAL PARAMETER DISTRIBUTIONS OF DISCRETE MATERIALS

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Key Words: *Stochastic Parameter Identification, Parameter distribution, Bayes' theorem, Bayesian Inference, Fibrous Materials, Discrete Materials, Foams, Textiles, Printed Lattices.*

Many materials consist of discrete constituents such as fibers, yarns and struts. Depending on their growth (for biological materials) or manufacture (for man-made materials), the difference between the material parameters of the individual fibers, yarns or struts can be substantial. If these discrete materials are to be modelled using strings of springs or beams at the mesoscale, the incorporation of this randomness of material parameters can substantially impact the predictions.

Different sets of material parameters for each discrete constituent are often generated by realising them from a probability distribution. Identifying the parameters of these distributions requires the testing of many discrete constituents however and is therefore not often performed in practise.

In this presentation we will present an approach employing Bayes' theorem that requires the testing of a couple of decades of discrete constituents, instead of hundreds. The approach essentially reduces the experimental efforts drastically, in exchange of computational efforts (although the implantation efforts are limited). A disadvantage of our approach is that assumptions for the shape of the distribution and initial estimates for its parameters are required, but we believe that these disadvantages do not outweigh the enormous reduction in experimental efforts.

Since we will only present results based on artificially generated data, the exact parameters we try to recover are known. Hence, we will be able to make rather accurate and consistent comparisons between the identified parameter values and the exact ones. This gives us for instance the possibility to investigate how an increase of the number of tested fibers results in an increase of the accuracy. We will furthermore not start the presentation with the most interesting application, but with a rather academic one in order to introduce the approach as clearly as possible [1].

REFERENCES

[1] Rappel H, Beex LAA, Bordas SPA, 'Bayesian inference to identify parameters in viscoelasticity', Mechanics of Time-Dependent Materials, 2017, In press.