The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

A Bayesian inference approach for parametric identification through optimal control method

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Keywords: *Inverse Problem, Identification, Bayesian inference*

The objective of this research is to introduce a parametric identification strategy based on full field measurements obtained from digital image correlation (DIC) [1]. Several deterministic strategies exist for DIC based identification strategies, and here an optimal control approach is presented which tries to negate the limitations of the existing strategies. This method consists of segregating the relations into reliable and less reliable sets, and it does not require complete information of the boundaries and measurement zone does not need to be on the complete structure. Thereafter the model updating procedure adjusts the model parameters in order to decrease the difference between the model prediction and the measurements.

Now, to address the error originating from model deficiency or measurement data stochastic analyses are necessary. In the present work, parametric model updating is investigated, through sampling using the deterministic problem, from a Bayesian perspective by considering all model parameters to be updated as random variables. Bayesian inference approach inculcates prior parametric information on the possible range of values using probability density functions [2]. This approach provides a robust framework for both model and measurement errors. The objective of the Bayesian inference is to obtain the posterior probability density with the informations of the prior density and error in model and/or measurement. In this respect Monte Carlo Markov Chain (MCMC) methods is used based on Metropolis–Hastings algorithm to obtain the posterior pdf. One limitation of model updating with MCMC sampling is its high computational cost, especially when applied to large/complex finite element (FE) models since each sample requires a full computation of the latter. Reduction in computational cost is achieved by using Radial Basis Function (RBF) network which circumvents the FE simulation by machine learning process.

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