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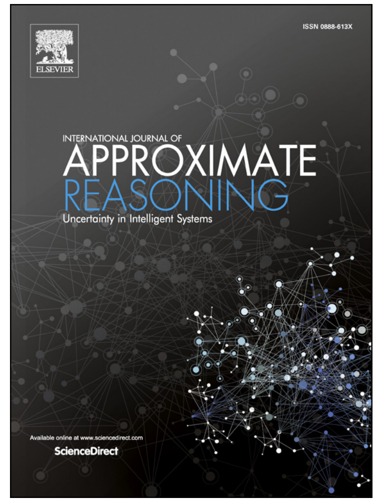

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Identification of Elastic Properties in the Belief Function Framework

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Abstract

Handling the uncertainty of information sources is a key issue in parameter identification. In this work, we address this issue using the theory of belief functions. First, measurement information is described through likelihood-based belief functions, and prior information is represented by an arbitrary belief function. Second, both belief functions are combined by Dempster's rule using point-cloud representation of focal sets and Monte Carlo simulation. Lastly, to summarize the combined belief function, we propose to find the minimal-area region in the parameter space, whose belief and plausibility values exceed given thresholds. As compared to Bayesian inference, this approach is more flexible, as it allows us to specify weak prior information. Experimental results show that it is also more robust than Bayesian inference to unreliable prior information.

Keywords: Mechanics, measurement field, prior information, aleatory uncertainty, epistemic uncertainty, likelihood, Dempster-Shafer theory, evidence theory, random set.

1. Introduction

In computational mechanics, more and more complex material models are used to meet the need for more predictive and accurate mechanical simulations. The parameters of these models have to be identified from experiments; consequently, identification of material properties remains a top-priority objective. As models get more complex, more information is needed from more elaborate experiments. In recent years, the use of full-field displacement measurements (based, in particular, on Digital Image Correlation (DIC) [1]) has rapidly spread

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