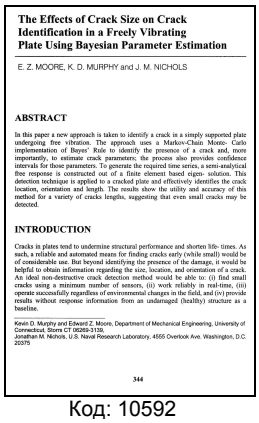

The Effects of Crack Size on Crack Identification in a Freely Vibrating Plate Using Bayesian Parameter Estimation

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ABSTRACT

In this paper a new approach is taken to identify a crack in a simply supported plate undergoing free vibration. The approach uses a Markov-Chain Monte- Carlo implementation of Bayes' Rule to identify the presence of a crack and, more importantly, to estimate crack parameters; the process also provides confidence intervals for those parameters. To generate the required time series, a semi-analytical free response is constructed out of a finite element based eigen- solution. This detection technique is applied to a cracked plate and effectively identifies the crack location, orientation and length. The results show the utility and accuracy of this method for a variety of cracks lengths, suggesting that even small cracks may be detected.

INTRODUCTION

Cracks in plates tend to undermine structural performance and shorten life- times. As such, a reliable and automated means for finding cracks early (while small) would be of considerable use. But beyond identifying the presence of the damage, it would be helpful to obtain information regarding the size, location, and orientation of a crack. An ideal non-destructive crack detection method would be able to: (i) find small cracks using a minimum number of sensors, (ii) work reliably in real-time, (iii) operate successfully regardless of environmental changes in the field, and (iv) provide results without response information from an undamaged (healthy) structure as a baseline.

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Ключевые слова:

Содержание.