Use of Response Surface Metamodels in Damage Identification of Dynamic Structures

by

Amanda L. Cundy

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Daniel J. Inman, Co-Chair
Mahendra P. Singh, Co-Chair
Romesh C. Batra
François M. Hemez

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Amanda L. Cundy
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Advisor: Daniel J. Inman

ABSTRACT

The need for low order models capable of performing damage identification has become apparent in many structural dynamics applications where structural health monitoring and damage prognosis programs are implemented. These programs require that damage identification routines have low computational requirements and be reliable with some quantifiable degree of accuracy. Response surface metamodels (RSMs) are proposed to fill this need. Popular in the fields of chemical and industrial engineering, RSMs have only recently been applied in the field of structural dynamics and to date there have been no studies which fully demonstrate the potential of these methods. In this thesis, several RSMs are developed in order to demonstrate the potential of the methodology. They are shown to be robust to noise (experimental variability) and have success in solving the damage identification problem, both locating and quantifying damage with some degree of accuracy, for both linear and nonlinear systems. A very important characteristic of the RSMs developed in this thesis is that they require very little information about the system in order to generate relationships between damage indicators and measureable system responses for both linear and nonlinear structures. As such, the potential of these methods for damage identification has been demonstrated and it is recommended that these methods be developed further.

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