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Numerical and experimental dynamic system identification for the development of operational modal analysis in a physics-based diagnostic/prognostic model

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Abstract
The work presented in this paper is a part of an ongoing research for developing a sound operationalmodal analysis for diagnostic and prognostic applications. The aim is to build a physics-based diagnostic/prognostic model, for condition monitoring purposes, with the ability to insert different types of faults. In this paper, a numerical model for a machinery fault simulator (MFS) is developed using rotor dynamic system analysis software XLRotor™. The use of the XLRotor™ software provides an ideal replacement for creating a traditional finite element model and is used as a base to build and assemble mass and stiffness matrices in Matlab® for a number of configurations of the test rig. The Matlab® code will form a valid base for developing a dynamic simulation model by the aid of Simulink®. A number of layouts of the MFS are tested and their corresponding models are created. Models include: the motor of the MFS, the coupling, the shaft, a number of inertia rotors at different locations, the rolling element bearings and the rotor pedestal (base). The results obtained from the model, in terms of the critical damped speeds and mode shapes are compared to those obtained experimentally for validation. Experimental validation includes simple bump. Numerical results obtained from this study were found to compare well with the experimental data. © The Society for Experimental Mechanics, Inc. 2014.

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