World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:8, No:11, 2014

In situ Modelling of Lateral-Torsional Vibration of a Rotor-Stator with Multiple Parametric Excitations

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Abstract : This paper presents a 4-DOF nonlinear model of a cracked of Laval rotor established based on Energy Principles. The model has been used to simulate coupled torsional-lateral response of the cracked rotor stator-system with multiple parametric excitations, namely, rotor-stator-rub, a breathing transverse crack, unbalanced mass, and an axial force. Nonlinearity due to a “breathing” crack is incorporated by considering a simple hinge model which is suitable for small breathing crack. The vibration response of a cracked rotor passing through its critical speed with rotor-stator interaction is analyzed, and an attempt for crack detection and monitoring explored. Effects of unbalanced eccentricity with phase and acceleration are investigated. By solving the motion equations, steady-state vibration response is obtained in presence of several rotor faults. The presence of a crack is observable in the power spectrum despite the excitation by the axial force and rotor-stator rub impact. Presented results are consistent with existing literature and could be adopted into rotor condition monitoring strategies

Keywords : rotor, crack, rubbing, axial force, non linear
Conference Title : ICME 2014 : International Conference on Mechanical Engineering
Conference Location : Cape Town, South Africa
Conference Dates : November 06-07, 2014

Open Science Index, Mechanical and Industrial Engineering Vol:8, No:11, 2014 publications.waset.org/abstracts/15695.pdf