

Experimental Verification of Piecewise Nonlinear Model Jeffcott Rotor with Snubber Ring

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Abstract

In this study the theoretical and experimental responses of a Jeffcott rotor with a snubber ring are compared. The model, which assumes a situation where gyroscopic forces are neglected, and concentrates on the dynamic responses caused by interactions between a whirling rotor and a massless snubber ring, which has much higher stiffness than the rotor. The nonlinearity in the form of a discontinuous stiffness is affected by the radial clearance between the visco-elastically supported rotor and elastically supported snubber ring. The rotor is placed eccentrically within this snubber ring and eccentricity was varied during the experiments.

In this paper the theoretical results obtained from the approximate model [1] and the numerical simulation [2] will be verified by the experimental work carried out on a slightly modified rig originally designed by Gonsalvez et al [3]. A detailed description of the experimental rig and the developed data acquisition system will be also presented, along with details of the procedures used to investigate the dynamical responses of the system.

By employing various techniques, like bifurcation diagrams and PoincarÉ maps, a comparison is made between the results obtained from the experiment and the theory for such parameters as forcing frequency and out-of-balance rotating mass. A good correlation between experimental and theoretical results was found. It was shown that the experimental model has mapped the basic bifurcation scenarios, which are observed in the theoretical model. This