

**EFFECT OF DAMPING AND FRICTION
ON THE ROTOR/SEAL FULL ANNULAR RUB**

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ABSTRACT

This paper presents an analysis of the rotor/seal system (or a rotor/retainer bearing system) in the condition of the full annular rubbing rotor against the stationary element. Based on modal considerations, a laterally isotropic nonlinear mathematical model of the system provides analytical solutions, which adequately represent observable phenomena. The model consists of two complex-degree-of-freedom equations and two rotor/seal nonlinear constrain conditions. This model provides two exact analytical solutions: the rotor system synchronous, unbalance-related response, modified by rubbing during rotor start-up/shutdown transient operation, and the self-excited response, called “dry whip,” which is independent of the rotational speed. The dry whip regime represents a serious malfunction of the rotating machine operation. The effect of system parameters on the responses has been investigated. Especially the role of system damping as well as the rubbing surface friction has been explored. Suggestions for minimization of dry whip occurrences in rotating machines and the model extension have been discussed.

Keywords: Rotor/seal full annular rub, damping and friction effect, modal modeling, synchronous response modified by rubbing, self-excited vibrations.