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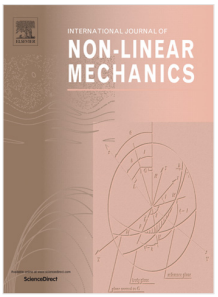

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Dynamics characteristics of a rotor-casing system subjected to axial load and radial rub

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Abstract: Aiming at the coupling fault of axial load and radial rub, a geometric nonlinear rotor-casing system is developed in this paper. For the actual case that the aero-engine components (i.e. compressor disc, turbine disc, stator casing, combustor and so on) are sprayed with thermal barrier coatings, the interaction between disc and casing is refined into four stages, including no rub, low rub, rub and high rub. With the increase of invasion depth, the corresponding force models are applied to describe the different impact mechanism. The frictional characteristic between disc and casing is described by the Coulomb model. Then the linear interpolation is used to predict the instantaneous contact of disc-casing and the nonlinear dynamic behaviors of the rotor-casing system subjected to axial load and radial rub are analyzed in the form of bifurcation diagram. Moreover, the rub-impact forms, such as full annular rubbing and partial rubbing, are identified by whirl orbit and waveform. On this basis, the dynamic comparison of the rotor system with/without axial load is conducted. The response variations caused by coating hardness and support stiffness of casing are further discussed.

Key words: rotor-casing system, axial load, radial rub, nonlinear dynamic behavior

1. Introduction

In recent years, larger axial load acting on rotors becomes a big issue regarding reliability of compressor, especially for applications in high temperature heat pump system [1-3]. Due to atmospheric turbulence, non-uniform combustion, installation preload and so on, rotating machine is often subjected to axial load, which may affect natural whirl speed, vibration stability and nonlinear dynamic behaviors [4].

Generally speaking, axial load acting on the rotating machine can be classified as constant force, periodic force and random force. Under this circumstance, a large number of researchers have

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