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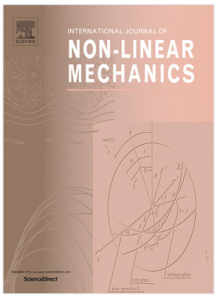

Effect of creep on the nonlinear vibration characteristics of blades with interlocked shrouds

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Effect of creep on the nonlinear vibration characteristics of blades with interlocked shrouds

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Abstract

In this paper, the influence of creep on the nonlinear vibrations of blades coupled by friction joints is numerically investigated. To this end, a model of a bladed disk with interlocked shrouds is considered. First, the time-dependent creep behavior under centrifugal loading and high temperatures is determined. For a discrete set of hold times, the deformed configuration and the conditions in the contact interfaces are extracted. A nonlinear modal analysis is then carried out to determine the amplitude-dependent damping and natural frequencies under consideration of the dynamic contact interactions in the shroud joints. It is found that for a given excitation level, the resonance frequency and the effective damping can deviate considerably from the initial ones. Moreover, the overall damping potential is slightly reduced.

Keywords: nonlinear vibrations, friction damping, bladed disk, tip shrouds, creep, nonlinear normal modes

1. Introduction

Turbine blades have to maintain their structural mechanical integrity over a long lifetime. The life is limited by damaging mechanisms including material and fretting fatigue, wear, erosion, corrosion and creep. The time-dependent, irreversible creep deformation can be caused by high centrifugal and thermal loads

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