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On the passing through resonance of a centrifugal exciter with two coaxial unbalances

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Abstract

Passage through and capture into the resonance of a centrifugal exciter with two coaxial unbalances driven by an engine of limited power is investigated using an averaging method for a partially strongly damped system. It is demonstrated that the system dynamics can be reduced on the slow manifold to two first-order differential equations that predict both stationary and transient solutions of the original system. The system shows two different types of solutions corresponding to the capture into the resonance. Their occurrence and existence range are investigated in terms of the dependency of engine parameters.

Keywords: averaging, nonlinear resonance, Sommerfeld effect

1. Introduction

For many decades, the passage through and capture into the resonance of rotating machines has remained an important topic of scientific research [1],[2]. Most analytical studies consider quasi-conservative systems [3],[4], and owing
 5 to the complexity of the mathematical analysis, are limited to describing the dynamics of systems with only one rotational degree of freedom [5]. However, to describe the dynamics of many mechanical systems such as a rotating cylinder partially filled with liquid[6], automotive drivetrain elements with coaxial shafts [7], and various types of vibration exciters [8], it is necessary to consider at least

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