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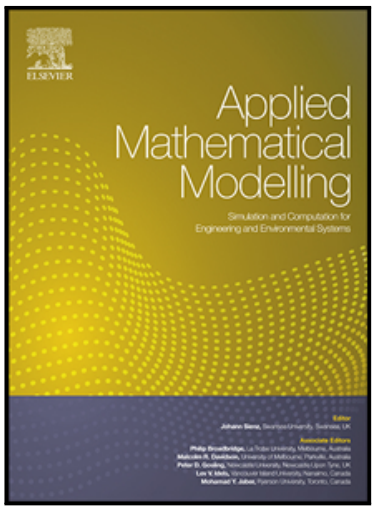

Predicting Nonlinear Dynamic Response of Internal Cantilever Beam System on a Steadily Rotating Ring

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Predicting Nonlinear Dynamic Response of Internal Cantilever Beam System on a Steadily Rotating Ring

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Highlights:

- Dynamic response of a internal cantilever beam fixed on a rotating ring is studied
- Analytical solution for beam vibration is obtained with improved Galerkin method
- Expression of Analytical approximate solution is explicit and brief
- Compared to numerical solution, accuracy of the approximate one is substantiated
- Effect of ring angular velocity on beam period and periodic solution is investigated

Abstract

This paper is focused on nonlinear dynamic response of internal cantilever beam system on a steadily rotating ring via a nonlinear dynamic model. The analytical approximate solutions to the oscillation motion are obtained by combining Newton linearization with Galerkin's method. Numerical solutions could be obtained by using the shooting method on the exact governing equation. Compared with numerical solutions, the approximate analytical solutions here show excellent accuracy and rapid convergence. Two different kinds of oscillating internal cantilever beam system on a steadily rotating ring are investigated by using the analytical approximate solutions. These include symmetric vibration through three equilibrium points, and asymmetric vibration through the only trivial equilibrium point. The effects of geometric and

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