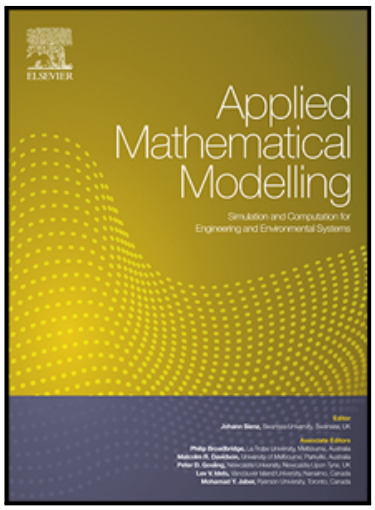

Vibration and stability analysis of a simply-supported Rayleigh beam with spinning and axial motions

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Vibration and stability analysis of a simply-supported Rayleigh beam with spinning and axial motions

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Highlights

- We modelled an axially moving Rayleigh beam with spinning motion.
- We analyzed the vibration and stability of the Rayleigh beam.
- We calculated more reliable natural frequencies and dynamic responses.

ABSTRACT

The vibration and stability of a simply supported beam are analyzed when the beam has an axially moving motion as well as a spinning motion. When a beam has spinning and axial motions, rotary inertia plays an important role on the lateral vibration. Compared to previous studies, the present study adopts the Rayleigh beam theory and derives more exact kinetic energy and equations of motion. The rotary inertia terms derived by the present study are compared to those of the previous studies. We investigate the natural frequencies between the present and previous studies. In addition, the critical speed and stability boundary for the spinning and moving speeds are also analyzed. It can be observed from the computed natural frequencies and dynamic responses that the present equations of motion are more reliable than the previous equations because the present equations fully consider the rotary inertia terms.

Keywords: Rayleigh beam; axially moving and spinning beam; vibration; critical speed; stability; dynamic response.

1. Introduction