Postprint: Adaptability Analysis of POD Reduced-Order Method for Cantilever Beams with Local Nonlinearity

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Abstract

In vibration control design for nonlinear structures, the order of structural models should not be excessively high. To this end, this study takes a cantilever beam with local nonlinearity as the research object to investigate factors affecting the accuracy of low-order models obtained via the POD model reduction method. The analysis focuses on the influence of nonlinearity strength, reduced-order model order, excitation type of source signals for POD mode acquisition, response signal sampling frequency, and response signal sampling duration on the response prediction accuracy of reduced-order models. The results demonstrate that the POD method remains applicable to locally nonlinear cantilever beam systems with strong nonlinearity. When selecting the excitation type for source signals, impulse excitation should be avoided. The sampling frequency and duration of responses need not be excessively large. Finally, a solution for applying the POD method to signals containing noise is proposed, providing a useful reference for engineering applications.

Full Text

Preamble

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