On the Perturbation Methods for Vibration Analysis of Linear Time-Varying Systems

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Some perturbation methods in the studying vibrations of the linear time-varying (LTV) system are discussed. Three classical perturbation methods, namely, averaging method, harmonic balance method, and multiple scales method with linear scales, have been used from a new perspective based on analytical approximations to the corresponding LTV ordinary differential equations. The deploying beam model has been taken as an example to validate the explicit approximate solutions obtained by these perturbation methods. It is demonstrated that such approximate solutions have good agreement with numerical and exact solutions, excluding the vicinity of the turning point.

Keywords: Multiple scales, Time-varying systems, Deploying beam problem, Perturbations

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