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Abstract

The continuous approximation is used in this work to describe the dynamics of a nonlinear chain of light oscillators coupled to a linear main system. A general methodology is applied to an example where the chain has local nonlinear restoring forces. The slow invariant manifold is detected at fast time scale. At slow time scale, equilibrium and singular points are sought around this manifold in order to predict periodic regimes and strongly modulated responses of the system. Analytical predictions are in good accordance with numerical results and represent a potent tool for designing nonlinear chains for passive control purposes.

Keywords: Nonlinear chain, Continuous approach, Vibratory energy, Time multi-scales method, Passive control

1. Introduction

Study of vibratory energy mitigation through addition of light structures was first studied in the early 1910's with the invention of what is usually referred to as Tuned Mass Damper (TMD) [1]. This linear added oscillator is tuned to a special frequency in order to oscillate in the opposite phase of the main system to reduce its oscillations. However, such systems tend to modify the dynamical characteristics of the overall structure. More importantly, if

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