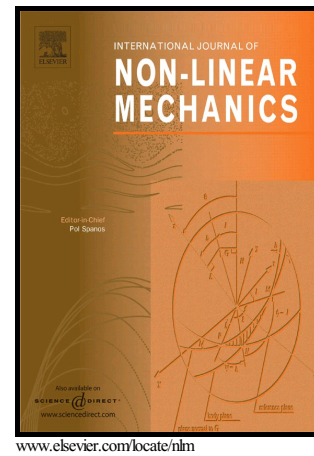


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On the response of purely nonlinear oscillators: an Ateb-type solution for motion and an Ateb-type external excitation

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Abstract

This study is concerned with free and forced undamped purely nonlinear oscillators. First, the exact closed-form solution for free vibrations given in terms of the Ateb function is discussed. An insight is provided with respect to the period of vibrations and the harmonic content of the response. Then, forced purely nonlinear oscillators with an Ateb-type external excitation are considered. The exact solution for the forced response is obtained, the amplitude-frequency equation derived and frequency-response curves investigated. It is also shown how one can adjust the system parameters to cause a constant frequency/period of the forced response.

Keywords: pure nonlinearity; Ateb function; external excitation; exact solution.

1 Introduction

Purely nonlinear oscillators are characterized by the restoring (elastic) force F_r that is a power function of the displacement x :

$$F_r \propto \operatorname{sgn}(x) |x|^\alpha, \quad (1)$$

where α is any positive real number. The sign and absolute value functions are used to assure that F_r is an odd function of the displacement for all the values of α defined.

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