

عنوان مقاله:

Nonresonant Excitation of the Forced Duffing Equation

محل انتشار:

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خلاصه مقاله:

We investigate the hard nonresonant excitation of the forced Duffing equation with a positive damping parameter E . Using the symbolic manipulation system MACSYMA, a computer algebra system. we derive the two term perturbation expansion by the method of multiple time scales. The resulting approximate solution is valid for small values of the coefficient e . As the damping parameter e increases, the accuracy of this solution degrades. In order to obtain an improved approximate solution to the given time dependent initial value problem, a hybrid perturbation-Galerkin method is applied to the perturbation solution. The hybrid method is based on Galerkin's method for determining an approximate solution to a differential equation using the perturbation solutions as trial functions. This hybrid method has the potential of overcoming some of the drawbacks of the perturbation method and the Galerkin method when they are applied separately, while combining some of the good features of both. We compare these two solutions for various values of e and W (the frequency of the external force) and demonstrate the effectiveness of the hybrid method. Both the perturbation and hybrid solutions are also compared to a fourth order Runge- Kutta solution of the Duffing equation. For small values of e , the hybrid solution is very close to the numerical solution for most values of W while the perturbation solution slightly overestimates the numerical solution. For larger values of e the perturbation solution deviates from the numerical solution very rapidly while the hybrid method remains close to the numerical model.

کلمات کلیدی:

Nonresonant, Excitation, Duffing Equation, Damping Parameter, Perturbation

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