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Calculating Periodic Solutions to 'Truly Nonlinear' Oscillatory ODE's[1] RONALD MICKENS, Clark Atlanta University — 'Truly nonlinear' oscillators (in one dimension) are modeled by second-order,ordinary differential equations having the form

$$(*) \qquad \ddot{x} + f(x) = \epsilon g(x, \dot{x}),$$

where the elastic restoring force $f(x)$ does not contain a linear term, ϵ is a positive parameter (which may or may not be small), and $g(x, \dot{x})$ is a polynomial function of $(x, \dot{x})$. A particular example of $f(x)$ is

$$(**) \qquad f(x) = x^{\frac{p}{q}}, \quad p = (2n+1), \quad q = (2m+1),$$

where (n, m) are non-negative integers. The significant issue for Eq. $(*)$ is that analytical approximations to its periodic solutions can be calculated. In general, when ϵ is small, Eq. $(*)$ does not have a mathematical structure such that the standard perturbation methods can be used. We demonstrate that an iteration procedure can be formulated such that excellent approximations to the periodic solutions are obtained for the ODE given by Eq. $(*)$. The method is illustrated by applying it to the case where $f(x) = x^3$ and $\epsilon = 0$.

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