1017-41-56 **Ronald E. Mickens*** (rohrs@math.gatech.edu), Box 1744 - Physics Department, Clark Atlanta University, Atlanta, GA 30314. *Construction and Analysis of Perturbation and Methods for 'Truly Nonlinear' Oscillatory Systems.*

Recent advances in molecular scale technology, with the creation of novel materials, can give rise to oscillatory phenomena for which the elastic forces may not be linear in the appropriate strain variable. For one dimensional systems, the equation of motion takes the form

$$(*) \qquad \frac{d^2x}{dt^2} + g(x) = \epsilon f\left(x, \frac{dx}{dt}\right),$$

where $g(x)$ and $f(x, y)$ have the properties

$$(**) \qquad g(-x) = -g(x), \qquad f(-x, -y) = -f(x, y),$$

with $\epsilon$ being a positive parameter. Particular examples of $g(x)$ include the functions $x^{1/3}$ and $x^3$. For this situation, even if $\epsilon$ is small, none of the standard perturbation techniques [1] can be applied to calculate approximations to the oscillatory solutions of Eq. $(*)$. The reason for this is that standard perturbation methods assume that $g(x)$ has a linear component and is analytic with respect to $x$. Note that $x^{1/3}$ has neither of these properties.

Our presentation will present two new procedures to deal with this type of oscillatory phenomena [2].

**References**

1. R. E. Mickens, *Nonlinear Oscillations* (Cambridge University Press, New York, 1981).
2. R. E. Mickens, *Journal of Sound and Vibration* **264** (2003), 1195–1200. (Received February 08, 2006)