Abstract Submitted
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Dynamics of Oscillatory Systems Having A Fractional Power Damping Force[1] RONALD E. MICKENS, Clark Atlanta University — In standard mathematical models of dynamic systems the effects of dissipation/damping is represented by a linear term proportional to the velocity, i.e., if x is a relevant coordinate, then this force is $F = -\lambda\dot{x}$, where λ is a positive parameter, and the over-dot denotes differentiation in time. For a conservative system, the application of such a force produces motions for which x goes to zero in an infinite time. We demonstrate that the use of a nonlinear dissipation/damping force proportional to $\dot{x}$ raised to a fractional power, i.e.,

$$F = -\lambda\,[sgn(\dot{x})]\,|\dot{x}|^a, \quad 0 < a < 1, \tag{1}$$

gives rise to dynamics for which the motion ceases in a finite time. Using the example of the Duffing equation and the method of first-order averaging, we illustrate this phenomenon. We also discuss the application of these results to the analysis of vibrations in nano-tubes and graphene sheets.

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