Mathematical Analysis of a Singular, Nonlinear, Periodically Driven Oscillator RONALD MICKENS, Clark Atlanta University — We investigate the possible solutions of the second-order differential equation

\[ m\ddot{x} + \dot{x} + x^3 = \sin t, \tag{1} \]

for the limiting case where \( m = 0 \). Applying the method of harmonic balance [1], we determine both first- and second-order approximations to the periodic solution. We also show, using the qualitative theory of differential equations [2], that this periodic solution is an attractor, i.e., regardless of the initial condition, \( x_0 = x(0) \), the solution eventually becomes arbitrarily close to this periodic solution. This work extends the results of Elias [3]. [1] Ronald E. Mickens., Oscillations in Planar Dynamic Systems (World Scientific, Singapore, 1996); see Chapter 4. [2] See ref. [1], Appendix I. [3] U. Elias, Qualitative analysis of a differential equation of Abel, MAA Monthly (February 2008), pps. 147-149.