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Analysis of the Lev Ginzburg Equation[1] MICHAEL BELLAMY, RONALD MICKENS, Clark Atlanta University — A second-order differential equation taking the form

$$(*) \qquad \ddot{x} = f(x, \dot{x}, p)$$

was derived by Ginzburg[1]. In this ODE, $\dot{x}$ and $\ddot{x}$ represent the first and second derivatives with respect to time; and p stands for four parameters, $p = (p_1, p_2, p_3, p_4)$, where (p_1, p_2, p_3) are non-negative and p_4 can be of either sign. The function f is linear in x, but quadratic in $\dot{x}$. Ginzburg's main purpose in constructing this equation was to take into consideration the "inertial behavior of biological populations." However, this ODE can also be used to model a variety of physical dynamical systems.[2] With four parameters, there is a broad range of possible solution behaviors. Our present purpose is to prove that limit-cycle behavior can occur for Eq. $(*)$ under the appropriate conditions on the parameters. We demonstrate this result by means of the Hopf bifurcation theory.[3] References [1]L. Ginzburg and M. Colyvan, Ecological Orbits (Oxford, New York, 2004). [2]S. H. Strogatz, Nonlinear Dynamics and Chaos (Addison-Wesley; Reading, MA; 1994). [3]E. Beltrami, Mathematics for Dynamic Modeling (Academic Press, Boston, 1987).

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