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HOPF BIFURCATIONS ON NONLINEAR MATHEMATICAL MODELS

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Abstract

In this paper, some interesting results on Hopf bifurcations, and a beautiful connection between Hopf bifurcations and Period- Doubling bifurcations are obtained. Some useful theory is developed in order to check the existence of Hopf- bifurcations on nonlinear mathematical models. For rigor, the following two models are considered for our purpose: The Williamowski and Rossler Chemical Chaos model:

$$\frac{dx}{dt} = (a_1 - k_1x - z - y)x + k_2y + a_3$$

$$\frac{dy}{dt} = (x - k_2y - a_5)y + a_2$$

$$\frac{dz}{dt} = (a_4 - x - k_5z)z + a_3$$

where a_1, k_1, k_2, a_2, k_5, a_3, a_4 and a_5 are parameters and the second model is the Generalised Henon map: $f(x, y) = (1 - \mu x_2 + y, bx + \_xy)$, where k is a nonzero positive constant, μ and b are parameters.

Key Words : Period doubling bifurcations, Hopf bifurcations, Concepts of supercritical and Subcritical

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