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BIFURCATION AND LYAPUNOV EXPONENT OF A CHAOTIC CUBIC MAP

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Abstract

In recent years, increasing research activity in the field of nonlinear systems has shown that even simple dynamical models can produce complex, seemingly random-looking behaviour, including the appearance of chaos. The universality discovered by M.J.Feigenbaum [1], [2] with non-linear models has successfully led to observe that large classes of non-linear systems exhibit transitions to chaos through period doubling route. In this paper, we have considered a one parameter cubic map, obtained the fixed points / periodic points and bifurcation values of periods 2^n, $n = 0, 1, 2, ...$ using suitable numerical methods and have shown how the ratio of three successive period doubling bifurcation points ultimately converge to the Feigenbaum constant. We have calculated the Feigenbaum α value [4] also. We have further verified our findings with the help of Time series analysis, Lyapunov exponent [6], [9] and the Bifurcation diagram of the cubic map .

Keywords: Period Doubling bifurcation / Chaos / Feigenbaum constant / Feigenbaum α value Lyapunov exponent