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CHAOS IN LOGISTIC MAP WITH EMIGRATION

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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 [1], [3], [6]. The Schwarzian derivative [2], [15]; The Sharkovski's theorem[9]; identification of period three point [6], [16] etc. help us to identify the chaotic nature of the map. One of the prominent, well defined routes to chaos is the Period Doubling route. The universality discovered by M.J.Feigenbaum [7], [8]; 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 map and identified its period three point analytically. Moreover, we have obtained the fixed points/periodic points and bifurcation values of periods 2^n, $n = 0, 1, 2, \ldots$ using numerical method and have shown how the ratio of three successive period doubling bifurcation points ultimately converge to the Feigenbaum constant. This ascertains that the map follows the period doubling route to chaos. We have further verified our findings by time series analysis, lyapunov exponent and the bifurcation diagram.

Keywords: Schwarzian derivative**,** Sharkovsky's theorem, Boundary crisis phenomenon, Escape region, Cob-web diagram, Period Doubling bifurcation, Feigenbaum constant, Lyapunov exponent, Bifurcation diagram.