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Where does the chaos of the logistics map arise? In the middle digits

ALVARENGA, João Pedro do Valle¹; BRUNO, Odemir Martinez¹

j.p.valle@df.ufscar.br

¹Instituto de Física de São Carlos - USP

This study investigates the emergence of chaos within the logistic map (1) by examining the significance of digits, specifically focusing on the most and least significant digits. The research aims to understand how these digits influence disorder and unpredictability in chaotic systems. Through a combination of entropy measures—Shannon Entropy (2), Approximate Entropy (3), and Sample Entropy—and visualization techniques such as Poincaré diagrams, phase space reconstructions, and autocorrelation plots, the study reveals that the most and least significant digits are associated with lower levels of disorder and higher predictability. In contrast, the intermediate digits exhibit greater levels of chaos. The findings suggest that chaos in the logistic map primarily begins in these intermediate digits, offering new insights into the origins of chaos. This research contributes to a deeper understanding of chaotic systems, highlighting the critical role of digit significance in the emergence of chaos.

Palavras-chave: Chaos theory; Logistic map; Pattern recognition.

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