

# Generation of Hyperchaos from the Chen-Lee System via Sinusoidal Perturbation

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## Abstract

A system with more than one positive Lyapunov exponent can be classified as a hyperchaotic system. In this study, a sinusoidal perturbation was designed for generating hyperchaos from the Chen-Lee chaotic system. The hyperchaos was identified by the existence of two positive Lyapunov exponents and bifurcation diagrams. The system is hyperchaotic in several different regions of the parameters  $c$ ,  $e$ , and  $x$ . It was found that this method not only can enhance or suppress chaotic behavior, but also induces chaos in non-chaotic parameter ranges. In addition, two interesting dynamical behaviors, Hopf bifurcation and intermittency, were also found in this study.

Keyword : Chen - Lee system,  
Lyapunov exponent,