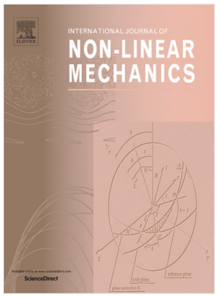

Chaos in a novel fractional order system without a linear term

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Chaos in a novel fractional order system without a linear term

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Abstract. In this paper, a novel three-dimensional fractional-order chaotic system without linear terms is proposed. Compared with other similar fractional-order chaotic systems, this system has two striking and unique features: (i) it exhibits robust chaotic behavior (i.e., sustained chaotic behavior) with respect to parameter *b* and more interestingly, the corresponding largest Lyapunov exponent becomes increasingly big with the increase of the parameter *b*; (ii) it can generate two twin symmetric strange attractors when the simulation time is reversed. To our knowledge, such a three-dimensional fractional-order chaotic system holding these two special features simultaneously has never been reported. Using standard nonlinear dynamical analysis tools including phase portraits, equilibrium stability, Poincaré map, bifurcation diagram, Lyapunov exponents and spectral entropy complexity, the complex dynamical behaviors of the system are systematically analyzed and investigated. And the complexity results well matches with that of the bifurcation diagrams, showing complexity can well reflect the dynamical properties of this fractional-order chaotic system. Furthermore, to validate the correctness and practical feasibility of the system under study, hardware electronic circuits with different fractional orders are designed. And the corresponding experimental results are also presented to confirm the theoretical analysis.

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