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A New Chaotic Supply Chain Model, Its Bifurcation Analysis, Multi-Stability and Synchronization Using Backstepping Control

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Abstract: A supply chain is a network of interconnected organizations, people, activities, information, and resources involved in the creation and distribution of products or services from the raw material stage to the end consumer. It encompasses the entire process of transforming raw materials into finished products and delivering them to customers. In this paper, we have proposed a new mathematical model for the chaotic supply chain with one absolute nonlinearity and one quadratic function. Furthermore, we have validated stability analysis and dynamical analysis using numerical MATLAB simulation. Our finding system exhibits the index-1 spiral saddle and index-2 spiral saddle. We show that the new chaotic supply chain model exhibits multistability with coexisting chaotic attractors for different initial states. Finally, as a control application, active backstepping control has been applied to achieve complete synchronization of a pair of new chaotic supply chain models taken as the master and slave systems. The Lyapunov stability theory has been used to achieve the control result using active backstepping control.

Keywords: *chaos; dynamical system; supply chain management.*

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