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Chaos Theory and Applications: A New Trend

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It is amazing and also exciting to see a new journal **Chaos Theory and Applications** established recently. After chaos was coined with a precise model, the Lorenz system, more than half a century ago Lorenz (1963), there have already been many well-known journals on chaos Sprott (2010) such as, to name just a few specialized ones, Chaos, Chaos Solitons and Fractals, International Journal of Bifurcation and Chaos, Nonlinear Dynamics, and several Physical Review journals. Therefore, on the one hand, organizing a new journal on chaos needs a lot of courage and planning, and on the other hand, one can see that the chaos is still an ever-young subject for scientific research today.

Typically, a subject with linearity by nature would last for one or two decades of active research before it turns to be mature or even becomes a toolbox for efficient applications, whereas a subject of nonlinear-ity in essence could last for much longer time or forever. Chaos is one example. The Lorenz system has been an icon of the subject for study, which is simple in form as a three-dimensional, autonomous, second-order polynomial system with three equilibria, but has extremely complex dynamics. Notably, it never exclude other possible chaotic models to be developed. Rössler system Rössler (1976) was another icon that is even simpler with only two equilibria, followed by yet an engineering model, Chua's circuit Matsumoto *et al.* (1985), which is a simple piecewise linear system, not to mention many others (e.g. the generalized Lorenz systems family Chen *et al.* (2020)).

Great progress notwithstanding, all that were not the end of the chaos story. Recently, it was found that there are many Lorenz-like chaotic systems, namely three-dimensional autonomous second-order polynomial systems, however without equilibrium, or with one stable equilibrium, or with two stable foci, or with infinitely many equilibria on a curve or a surface in the three-dimensional phase space Chen *et al.* (2020). They were classified to be systems with hidden chaotic attractors Wang *et al.* (2021); Leonov and Kuznetsov (2013). In these systems, the traditional bifurcation analysis is inapplicable, since even eigenvalues of Jacobians at equilibria do not exist or cannot be well defined, thereby the familiar bifurcation analysis cannot be performed to characterize chaos, or to find a route to chaos, in such unusual non-hyperbolic systems. This poses great challenges to theorists in the field of bifurcation and chaos.

It is our expectation, therefore, that the new journal **Chaos Theory and Applications** could contribute more to this new direction of chaos research, along with other traditional topics.

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