Chaos, Uncoupled and Pragmatical Synchronization and Anti-synchronization of Integral Order and Fractional Order Double Van der Pol System

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ABSTRACT

In this paper, the chaotic behaviors in a integral and fractional order double van der Pol system are studied numerically by phase portraits, Poincaré maps. Linear transfer function approximations of the fractional integrator block are calculated for a set of fractional orders in [0,1], based on frequency domain arguments. The total system orders found for chaos to exist in such systems are 3.9 to 0.4. The chaos synchronizations of two uncoupled chaotic double van der Pol systems are obtained. By replacing their corresponding parameters by the same function of chaotic state variables of a third chaotic system, the chaos synchronization can be obtained. The method is named parameter excited chaos synchronization which can be successfully obtained. And show that either synchronization or anti-synchronization depends on initial conditions and on the strengths of the variable. Numerical simulations are illustrated by state error plots. Next，study by a white noise and Rayleigh noise displace the third system, and observe the Chaos complete synchronization and antisynchronization of the two uncoupled systems. Finally, using pragmatical adaptive control method, control a chaotic double van der Pol system to a given chaotic double Duffing system.