整數階與分數階雙 Mackey-Glass 系統的渾沌,延遲,超前,非耦合渾沌同步及控制

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摘要

本篇論文以相圖及分歧圖等數值方法來研究雙 Mackey-Glass 系統的整數階與分數階的渾沌行為。同時發現了當兩個非耦合的雙 Mackey-Glass 系統其初始值有些微差異時，即使沒有加入控制項，此兩系統可達到暫態延遲或超前同步及暫態延遲或超前反同步，當所有初始值為正時，可獲得暫態延遲或超前同步，但當初始值有負值存在時，系統軌跡會產生對 x 軸對稱的倒轉現象，即獲得暫態延遲或超前反同步，上述的延遲或超前同步會交替出現。接著利用參數激發法來控制雙 Mackey-Glass 系統，使系統能在零點漸近穩定，並使兩個非耦合的雙 Mackey-Glass 系統達到同步與延遲同步。此法是將系統中相對應的參數以噪訊取代，本文利用高斯噪訊、Rayleigh 噪訊、Rician 噪訊及均勻噪訊並調整其噪訊之強度，可消除雙 Mackey-Glass 系統的渾沌特性而在零點穩定，且可使兩個非耦合的雙 Mackey-Glass 系統達成同步。此外，當此控制法作用於第一系統與第二系統時存在一個時間差，意即第一系統的相對應參數在 t=0 秒時以噪訊取代，而第二系統之相對應參數在 t=d 秒時取代，此兩非耦合系統可達延遲同步。同時，暫態延遲與部分延遲同步也可達成。系統在此法作用下對微小擾動具有強健性。

Chaos, Lag, Anticipated and Uncoupled Chaos Synchronization and Control of Integral and Fractional Order Double Mackey-Glass Systems

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Abstract

Chaotic behaviors of integral and fractional order double Mackey-Glass time delay systems are studied by phase portraits and bifurcation diagrams. It is discovered that temporary lag and anticipated synchronization and temporary lag and anticipated anti-synchronization appear for two identical double Mackey-Glass systems, without any control scheme or coupling terms, but with different initial conditions. When all initial conditions are positive, the lag (anticipated) synchronization is obtained. The negative initial values make the time history inverse and temporary lag (anticipated) anti-synchronization occurs. The phenomena both appear intermittently. The parameter excited method is applied to control chaos of a double Mackey-Glass system and to synchronize two uncoupled identical double Mackey-Glass systems. By replacing a parameter of the chaotic system by the Gaussian noise, Rayleigh noise, Rician noise and uniform noise signal respectively, chaos control can be obtained. By replacing the corresponding parameters of these two chaotic systems by any of the mentioned noise signal, chaos synchronization can be obtained. Afterward, lag synchronization of two uncoupled double Mackey-Glass systems by parameter excited method is presented. By replacing the corresponding parameters with two lag

Rayleigh noise signals, the lag synchronization can be successfully achieved. Temporary lag synchronization, partial lag synchronization and robus tness of lag synchronization are also obtained by this method.