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Hindmarsh-Rose 神经网络的混沌同步

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研究了通过特殊构造的非线性函数耦合连接的神经网络的混沌同步问题。在发展基于稳定性准则的混沌同步方法的基础上，给出了计算同步稳定性的误差发展方程，当耦合强度取参考值时，可实现稳定的混沌同步而不需要计算最大条件Lyapunov指数去判定是否稳定。通过对按照完全连接形式构成的Hindmarsh-Rose神经网络的数值模拟，显示可仅从两个耦合神经的耦合强度的稳定性范围预期到许多耦合神经实现同步的稳定性范围。 该方法在噪声影响下，对实现神经元的混沌同步仍具有较强的鲁棒性。此外发现随着耦合神经数的增加，满足同步稳定性的耦合强度减小，与耦合神经的数量成反比。

The Chaotic Synchronization of Hindmarsh-Rose Neural Networks

The chaotic synchronizations of neural networks linked by a nonlinear coupling function were discussed. The method was an expansion of SC method of chaotic synchronization based on the stability criterion. The evolutional equation of the difference was provided for calculating the synchronization stability. The stable chaotic synchronization could be achieved without calculation of the maximum conditional Lyapunov exponent when the coupling strength was taken as reference value. H-R neural network according to all-to-all form are treated as numerical example. It was shown that the stability region of coupling strength of numerous coupling neurons for achieving chaotic synchronization each other could be expected from estimating stability region of two coupling neurons only. Besides, the authors found that with increasing of the number of the coupled neurons, the coupling strength of satisfying stability equation of synchronization decreased. In order to achieve synchronization of a great deal coupling neurons in a network, we only need very low coupling strength. This method is still robust for chaotic synchronization even if with the influence of noise.

关键词

混沌同步(Chaotic synchronization); 非线性耦合(Nonlinear coupling function); 稳定性准则(Stability criterion); H-R神经网络(H-R neural networks); 噪声(Noise)