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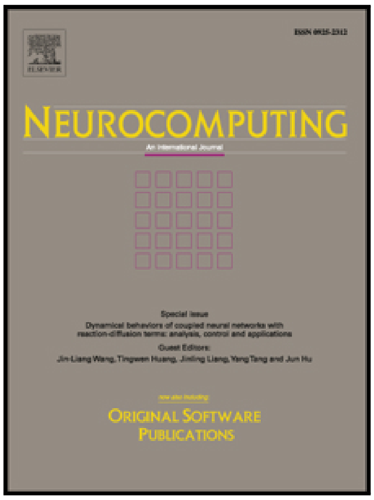

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Hopf bifurcation analysis of a delayed fractional-order genetic regulatory network model

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Abstract In this paper, we propose a novel fractional-order two-gene regulatory network model with delays, which can describe the memory and hereditary properties of genetic regulatory networks more suitably. It is the first time that the dynamics of the stability and Hopf bifurcation are investigated for the delayed fractional-order model of two-gene regulatory network. The total delay is chosen as the bifurcation parameter of the network, and the sufficient conditions of the stability and Hopf bifurcation are achieved through analyzing its characteristic equation. It is found that the delayed fractional-order genetic network can generate a Hopf bifurcation when the total delay passes through some critical values, which can be determined exactly by dealing with the characteristic equation of the network. Finally, the validity of our theoretical analysis is illustrated by carrying out the numerical simulation for the example, and some desirable dynamical behaviors of the case are obtained by choosing the appropriate fractional order. It is discovered that the onset of the Hopf bifurcation increases distinctly when the fractional order deceases. Therefore, the stability domain of the network is inversely proportion to the fractional order of the network.

Keywords Time delays・Hopf bifurcation・Fractional-order・Genetic regulatory networks

1. Introduction

It is generally known that the genetic regulatory network is an extremely intricate dynamical model, which is composed of genes and gene products by the regulatory interaction of them. With the advancement of genomics, genetic regulatory networks have attracted teams of researchers. The network can show the interaction functions of genetic expression in living body cell [1], which describes the reciprocities between

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