Generalized Wright stability for distributed fractional-order nonlinear dynamical systems and their synchronization

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Abstract:

In this article, we present a generalization of stability theorems for Caputo fractional derivative to the distributed fractional-order (DFO) case by using the Laplace transform and the asymptotical expansion of the generalized Mittag-Leffler function. We propose the definition of the generalized Wright stability to study the stability of DFO nonlinear dynamical system using Lyapunov direct method. The linear feedback control is used to stabilize a class of chaotic DFO nonlinear dynamical systems. Using Lyapunov direct method, we study the synchronization between two identical chaotic systems and between two other different in the linear terms. The chaotic DFO Lorenz system is given as an example to achieve the linear feedback control technique. Another two examples which are chaotic DFO complex Chen and L"{u} systems are used to show the validity and feasibility of our proposed synchronization scheme. Numerical simulations are implemented to verify the results of these investigations.

Keywords:

Distributed fractional-order system;Asymptotic stability; Gronwall inequality; Generalized Wright stability; Linear feedback control; Synchronization

Published In:

Nonlinear Dynamics, 97(1), 413-429, DOI: 10.1007/s11071-019-04979-7, July, 2019. , (1)97 , 413-429