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Stability Analysis of Phase Synchronization in Coupled Chaotic Systems Presented by Fractional Differential Equations

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Abstract: In this paper, we have considered phase synchronizations in coupled chaotic systems presented by fractional differential equations. This synchronization occurs when some eigenvalues of the matrix found in the linear approximation of difference evolutional equation between coupled chaotic systems have zero real parts. Here, we have used nonlinear feedback function for synchronization. We have also demonstrated some numerical examples to show the accuracy of our analytical stability in some coupled chaotic fractional differential equations.

Keywords: *chaos; synchronization; fractional differential equations.*

Mathematics Subject Classification (2000): 34H10, 34D06, 34A08.

1 Introduction

As Pecora and Carroll have shown [1] in coupled chaotic systems, a complete synchronization occurs if the difference between various states of synchronized systems converges to zero. They have also shown that, synchronization stability depends upon the signs of the conditional Lyapunov exponents. That is, if all of the Lyapunov exponents of the response system under the action of the driver are negative, then there is a complete and stable synchronization between the drive and response systems. Stability of the synchronization can also be verified using the Jacobian matrix in the linearized system, where the linearized system represents the state difference between the drive and response chaotic systems [2]. Following this stability analysis and despite the theory of stability analysis in dynamical system, if this Jacobian matrix is of full rank and all of

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