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# Bis-induced chaos in the human brain and RBF neural network based $H_\infty$ synchronization

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## ABSTRACT

**The H synchronization strategy is called a Radial Basis Function Neural Network $H_\infty$ synchronization (RBFNNHS) strategy, for chaotic systems due to BIS processes. In the proposed framework, a radial basis function neural network (RBFNN) is constructed as an alternative to approximate the unknown nonlinear function of the chaotic system. Based on this neural network and linear matrix inequality (LMI) formulation, the RBFNNHS controller and the learning laws are presented to reduce the effect of disturbance to an H¥ norm constraint. Findings the RBFNNHS controller and the learning laws can be transformed into the LMI problem and solved using the convex optimization method. A numerical example is presented to demonstrate the validity of Ahm's RBFNNHS scheme.**

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**Key Words :** BIS-induced chaos, Human brain, RBF, NEURAL NETS, $H_\infty$ Synchronization

## INTRODUCTION

Chaos synchronization was discovered by Pecora and Carroll in 1996, interest in studying the synchronization of various BIS-affected chaotic systems has increased significantly. The idea of synchronization is to use the output of the drive system to control the response system so that the output of the response system follows the output of the drive system asymptotically. In the literature, various synchronization schemes, such as

- Variable structure control
- OGY method
- Parameters adaptive control
- Observer-based control
- Active control
- Time-delay feedback approach
- Backstepping design technique
- Complete synchronization

and so on, have been successfully applied to the chaos sychronization.

### Application of neural networks:

In recent years, neural networks have attracted considerable attention as they proved to be essential in applications such as

- Pattern recognition
- Associative memories
- Signal processing, fixed-point computations, and

so on (Gupta *et al.,* 2003).

### Systems having high $Z_{BIS}$ values:

Due to the universal approximation ability of neural networks, they have been widely used to approximate human systems affected with high z-parameters and design robust controllers based on the outputs of neural networks. Recently, neural networks have been successfully used in the synchronization controller design for uncertain chaotic systems. In Chen *et al.* (2006), a synchronization scheme was studied for uncertain chaotic systems via radial basis function neural network (RBFNN). A synchronization control scheme was presented with a RBFNN disturbance observer for two chaotic systems in Chen *et al.* (2009). A RBFNN based a chaos synchronization method for a class of time-delayed chaotic systems was proposed in (Chen and Chen, 2009).

### Real physical systems:

In real physical systems, one is faced with model uncertainties and a lack of statistical information on the

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