2nd National Conference on New Researches in Electrical and Computer Engineering
tehran-2017

Adaptive RISE control for chaotic oscillation in power system using wavelet neural network identifier

Seyyed Mohammadreza Ebrahimi [1] - Milad Malekzadeh[2] , -Alireza Khosravi[3*]
[1] Faculty of Electrical Engineering, Babol Noshirvani University of Technology
Email address: Ebrahimi.mr1@gmail.com
[2] Faculty of Electrical Engineering, Babol Noshirvani University of Technology
Email address: m.malekzade@stu.nit.ac.ir
[3] Faculty of Electrical Engineering, Babol Noshirvani University of Technology
Email address: akhosravi@nit.ac.ir

ABSTRACT

Chaotic behavior is an unfavorable phenomenon in power systems which can cause irrecoverable damages. Such dynamic in power systems is a great threat for stability, thus controlling of this dynamic behavior is great importance. Considering the chaotic dynamics and the unpredictable behavior of this phenomenon, implementing its exact mathematical model has some difficulties, thus controlling this phenomenon is difficult due to existence of un-modeled nonlinear terms or non-structural uncertainty. In this paper an adaptive-predictive control scheme is proposed which shows suitable ability in controlling dynamics without sufficient information by employing wavelet neural network as the identifier. The neural network employed in training process learns to estimate the output behavior of the system one step ahead and then to adjust the controller's coefficients using the proposed adaption rules. In order to control the chaos, a robust controller called RISE (robust integral of the sign of the error) feedback is used which benefits a robust pattern for controlling uncertain dynamics in its control scheme. Performance of this control scheme is compared with adaptive PID controller and the simulation results confirm the effectiveness of the proposed method.

Keywords: power system; wavelet neural network; RISE (robust integral of the sign of the error) feedback; Chaos.

INTRODUCTION

One of the nonlinear dynamics which has attracted attentions throughout the past two decades is the chaotic systems. One of the most important characteristics of the chaos system is that the feedback of the initial behavior affects the rest of the trajectory. In other words, the first output product plays a role in the rest of the process and shows an unpredictable behavior. Due to the unpredictable and destructive behavior of the chaotic state especially in physical systems, controlling the chaotic states is important matter. Chaotic behavior in power systems is an unfavorable phenomenon which affects the stability of the system and might cause instability and even blackout in power systems [1]. In recent years, many of the European and American countries have faced such problems [2,3]. Thus a lot of studies have been conducted in the context of chaos and instability of power systems. For example in [4], the relationship between chaotic behavior and instability modes of different power systems have been studied or in [5] it has been reported for the first time that chaotic fluctuations may cause phase divergence and voltage collapse. Large interconnected power system is a type of nonlinear complex dynamic system which shows extreme nonlinear behavior by power perturbation variations. Variations of power perturbation amplitude may cause chaos phenomenon in power