Firing Angle Control of TCSC Using Emotional Learning Based Fuzzy Controller

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Extended Abstract

This paper describes the application of Emotional Learning Based Fuzzy Controller (ELBFC) to Thyristor Controlled Series Capacitor (TCSC), which might have a significant impact on power system dynamics. The function of an ELBFC is to control a firing angle of TCSC. A proposed ELBFC is used for damping the low frequency oscillations caused by disturbances such as a sudden change for small or large loads or an outage in the generators or a transmission lines. To evaluate the usefulness of the proposed ELBFC, we perform the computer simulation for a single-machine infinite system. Simulation results show that ELBFC has the better control performance than PD controller in terms of settling time and damping effect, when the three phase fault under the heavy load used in tuning ELBFC occurs. To evaluate the robustness of an ELBFC, we analyze the dynamic characteristic of generator for a changeable mechanical torque in heavy load and change of a mechanical torque and three phase fault in nominal and light load.

The emotional learning based fuzzy controller (ELBFC) is a model-free method which has three distinctive properties in comparison with other neurofuzzy learning algorithms. For one thing, one can use very complicated definitions for emotional signal without increasing the computational complexity of algorithm or worrying about differentiability or renderability into recursive formulation problems. For another, the parameters can be adjusted in a simple intuitive way to obtain the best performance. Besides, the training is very fast and efficient. As can be seen these properties make the method preferable in real time applications like control tasks, as have been presented in literature. In this approach, which in a way is an extension to reinforcement learning, there exists an element in the control system called critic whose task is to assess the present situation which has resulted from the applied control action in terms of satisfactory achievement of the control goals and to provide the so called emotional signal (the stress). The controller should modify its characteristics so that the critic’s stress is decreased. This is the primary goal of the proposed control scheme.

Reference
