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INTERVAL TYPE-2 FUZZY FINITE-TIME CONTROL APPROACH FOR CHAOTIC OSCILLATION DAMPING OF POWER SYSTEMS

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Abstract. *In this paper, a novel fuzzy finite-time variable structure controller for double integrator power systems is proposed. An interval type-2 fuzzy controller is developed to improve controller robustness against system uncertainties and unknown disturbances. Proposed controller is able to damp the complicated chaotic oscillations of an interconnected power system, when such oscillations can be made by load perturbation of a power system working on its stability edges. Lyapunov functions are used to prove stability of proposed controller and simulation results are implemented on a 2-machine interconnected power system, illustrating the effectiveness of proposed method even in comparison with other previous methods.*

Keywords: Finite-time stabilization, Interval type-2 fuzzy system, Swing system, Chaotic oscillation damping

1. **Introduction.** Transient stability is one of the most important aspects of power system stability studies on account of its highly nonlinear features. Routs to unstable conditions must be recognized in order to find out effective ways of confining system in its stable constrains.

It is confirmed that one of the complex phenomena in nonlinear systems is chaos, which can propel power system to instability. Due to this fact, many researchers concentrate on proposing methods to control chaotic oscillation in electrical systems.

The first work on chaos control was presented by Ott et al. [1] in 1990, followed by Ajjarapu and Lee [2], who studied the nonlinear dynamical phenomenon in a power system network. A technique for recognizing and classifying chaotic behaviors was presented in [2]. Chiang et al. [3] investigated the existence of chaos for certain loading conditions. Srivastava et al. [4] considered the effect of On-Load Tap Changer (OLTC) dynamics and Static VAR System (SVS) under chaotic oscillations. The chaotic blue sky bifurcation in voltage collapse was determined in [5]. Chaotic dynamic in the swing equation of a damped power system was proved in [6], and the effectiveness of FACTS devices to damp out the hopf bifurcation and chaos in power systems was demonstrated in [7]. Recently, Noroozi et al. proposed a controller based on variable structure method for a 2-machine interconnected power system with robustness to external disturbances [8].