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Development of MADB of P-I controller using LMI technique in a renewable energy based AGC system and study its application in a deregulated environment including energy storage device

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Abstract

In recent decades, inclusion of renewable resources is considered as one of the most promising options for the long run uninterrupted power supply without depending on conventional resources. Thus, the renewable energy generation will get more attention and massive growing, so that the goal of 40% share of electricity in the worldwide energy portfolio in 2050 would be realized. But during replacement of renewable energy by conventional energy, engineers are facing a lot of problem due to solar generation, wind generation change their characteristic rapidly with weather condition, which may cause large synchronizing imbalance between different units and generate large system delay or communication delay in large interconnected grid. In this article, the authors propose linear matrix inequalities techniques to developed margin of allowable delay for delay dependent stable hybrid system. Initially, to judge the efficacy of proposed chaotic atomic search optimization (CASO) algorithm over other evolutionary algorithms with PID controller, a thermal-hydro gas system is considered. The second part of this article is motivated by the fact that proposed CASO algorithm with P-I controller is superior in contrast to bacterial foraging algorithm technique. In addition to this, some energy storage devices such as fuel cell, aqua electrolyzer, and ultra-capacitor are used to achieve a better dynamic response within specified delay margin. Moreover, to study the impact of communication delays (delay margin) due to the loss of synchronism between solar-wind (for their unpredicted environmental features) and thermal unit (nonlinearities like generation rate constraints, boiler dynamics, and governor with the dead band) are considered in thermal unit and the simulation results verify with the effectiveness of the proposed approach on providing a balance between the delay margin and the damping performances is evaluated under deregulated environment. The simulation results help to make an inter-relation

