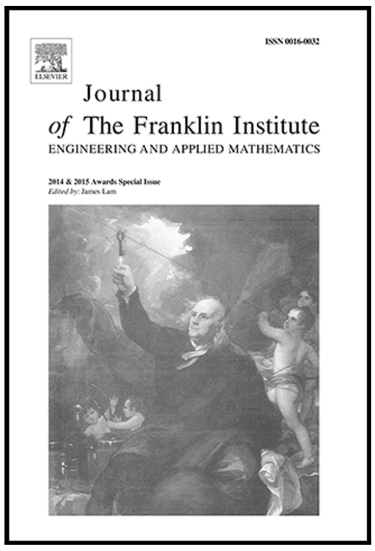

Synergetic Governing Controller design for the hydraulic turbine governing system with complex conduit system

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Synergetic Governing Controller design for the hydraulic turbine governing system with complex conduit system

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Abstract: The hydraulic turbine governing system plays an indispensable role in maintaining the stability of electrical power system. In this paper, synergetic control theory is introduced to enhance the regulating ability of the hydraulic turbine governing system. For the purpose of describing the characteristics of objective system and deducing the synergetic control rule, a nonlinear mathematic model of a hydraulic turbine governing system with long tail race and two surge tanks is established. Furthermore, the nonlinear characteristic of the hydraulic turbine is described by six variable partial derivatives. For further investigation, the hydraulic turbine governing system is conducted to running under load condition when its coaxial generator connects to an infinite bus. Simulation experiments have been made under both load disturbance and three-phase short circuit fault conditions to compare the dynamic performances of proposed synergetic governing controller and classic PID controller. The results indicate that the proposed synergetic governing controller is an effective alternative in normal condition and a superior one in emergency. Moreover, the robustness of synergetic governing controller has also been discussed at the end of this paper.

Keyword: synergetic control; nonlinear hydraulic turbine; complex conduit system; hydraulic turbine governing system

1. Introduction

In recent years, with the increasing penetration of power generated using various intermittent renewable energy sources, such as wind power, solar energy, there comes a new challenge to the stability and absorptive capacity of power grid [1-3]. In this regard, it is important to find a method to neutralize the harmful effect brought by the intermittent renewable energy source without too much cost. Thus,

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