MODELING AND STABILITY ANALYSIS OF ELECTRO HYDRAULIC GOVERNOR IN HYDRO POWER PLANTS

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ABSTRACT

Global renewable energy generation has been on the rise over the last few decades and continues its strong progress in energy sector. Of all renewable energy sources, hydro power is renewable, environment friendly and has high energy pay back ratio. It not only offers clean energy but also provides additional facilities such as water services, energy security, regional cooperation and balanced socio-economic development. The flexible generation technology asset as well as energy storage in reservoirs has led to crucial driving agent for global development. Therefore, hydro power is important and cost-effective renewable energy source of electricity generation worldwide. The power sector is one of the key economic drivers of world’s economy. With the construction of new hydropower plant and development of inter-area transmission network, the power system stability becomes a challenge.

The constant speed requirement of hydro turbine-generator set is met by critical device called speed governor. Therefore, speed governor of hydraulic turbine controls its speed or power for specific purpose. Diverse disturbances emerge in the power system and stability becomes a great concern as the process is not linear. In order to study the stability of speed governor of hydraulic turbine unit in the power plant, the modeling is identified as fundamental platform.

Under the present dissertation work, modeling and analysis on stability of electro-hydraulic governors on hydropower plants is carried out. An extensive literature review is carried out on modeling and stability problems on hydropower plant and electro-hydraulic governor. The model of the hydropower plant using MATLAB, Simulink is developed. The characteristics of plant under different operating conditions are presented. The investigations on stability of electro-hydraulic governor when subjected to external disturbances such as transients due to load change as well as three-phase fault in power system are illustrated. For the interconnected hydropower plant, comparative investigation on PID and PI governors on different operating conditions are also presented. Based on simulation results of model of hydropower plant, it has been found that change of derivative gain to higher value led to instability of governor. The electro hydraulic PI governor resulted better output for grid connected plant under to transient fault conditions.