

INTERACTIVE EXCITATION AND SPEED GOVERNOR CONTROL OF POWER SYSTEMS

by
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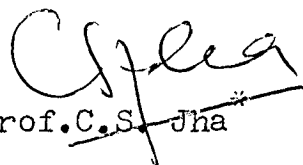
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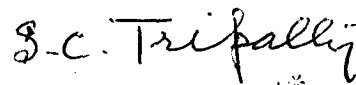
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(T. S. Bhatti)

ABSTRACT

In this thesis, results of simulation studies on power systems with interactive automatic generation control and excitation control loops are reported. The parameter of large generators affect the stability margins and in order to enhance these stability margins most large generating units are equipped with power system stabilizers^{36,50}. The interaction between the two main control loops prevails due to the incorporation of a frequency deviation stabilizing signal in the excitation control loop through a power system stabilizer. Two types of power system stabilizers have been considered, namely, one with transient gain reduction and the other without transient gain reduction. The effects of load voltage characteristic, power system stabilizer gain, transient gain reduction and generator parameters on the stability of the interactive automatic generation and excitation control system have been investigated.

As random power impacts occur during the normal operation of a power system, the selection of system parameters on the basis of deterministic load changes may result in non-optimum parameter values. Therefore, a stochastic Liapunov technique has been developed to optimize system parameters when the system is subjected to random load

changes. Liapunov equations have been derived for evaluating system performance indices both for continuous and discrete time case.

The area control error (ACE) signal is usually composed of frequency and tie-line power changes only. While considering the interactive automatic generation control and excitation control systems, the ACE is considered to be composed of frequency, tie-line power as well as terminal voltage deviations from their nominal values. The addition of voltage change signal to ACE has been considered for the first time for power systems having frequency deviation as a supplementary stabilizing signal.

The parameters that have been optimized for a two area interconnected power system are the stabilizer gain, transient gain reduction, frequency bias parameter, voltage bias parameter and proportional and integral controller gains. The optimum values of the above parameters have been sought using the Liapunov technique, both for continuous **and** discrete time cases, as well as for deterministic and stochastic load changes. Responses for frequency, tie-line power, terminal voltage, exciter voltage and speed changer position deviations for the optimum set of parameter values have been shown.

The effect of the governor dead-band on the stability of the interactive automatic generation and excitation control

systems has been studied. The investigations have been performed on an interconnected power system of two areas, having hydro and/or thermal generations.

To test the validity of computer simulation results and to develop new power system control strategies, development of p.s. control models with accessories becomes necessary. With this end in view, hardware for monitoring power system variables under steady state and transient conditions using a micro-alternator and micro-computer has been developed.

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