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Small Signal Stability in Power Systems: Concept and Control

Ahmed Abdulsalam Abdulqader

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Small Signal Stability in Power Systems: Concept and Control Ahmed Abdulsalam Abdulqader Synchronous generator stability is an essential issue in the studies of dynamic performance of electric power systems. One important category of stability analysis is the low-frequency oscillations of machine rotor due to disturbances to which the power system is susceptible. These oscillations may sustain and grow in magnitude to cause machine separation if adequate damping is not provided. To enhance system damping, the generating unit is equipped with a power system stabilizer (PSS). Conventional PSS's are widely utilized to damp the low-frequency inertial oscillations. The design of such stabilizers involves finding the set of PSS parameters which yield the best achievable damping response. Several design approaches were proposed over the years and some of them are given in the literature review of this study. A novel genetic-algorithm based optimization approach to design a robust PSS is presented in this study. The proposed approach employs optimization of damping to obtain minimum speed deviation and best possible time-domain transient performance. The single machine infinite bus system is used in this work. Simulations of the linearized system in addition to a simpower model based on the SimPowerSystems® are presented. The machine speed response has been investigated for both models in the case of Classic-PSS and GA-PSS designs. Their results are compared at different operating conditions, and the comparison shows that the proposed method gives encouraging results against classic method based on system response while being subjected to disturbances which mean that the system maintains its stability during (±20 %) of perturbations in the load or the system is robustly stable.

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