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Abstract

The use of the dual excitation system for improving the overall performance of a self-excited synchronous machines is considered, along with the replacement of the compound transformer and rectifier bridge by a potential transformer and thyristor bridge for the self-excitation system. The output DC voltage of the bridge is controlled over a wide range by an automatic feedback control circuit to vary the firing angle of the thyristors in such a way that the terminal voltage is sustained at a constant value. The mathematical models for two distinctive alternatives of the excitation system are derived. The mathematical model thus derived is suitable for transient, dynamic as well as steady-state analysis. However it should be modified to investigate the steady-state and dynamic performance. Exact steady-state operating points are achieved by solving the steady-state equations obtained from the general model. Charts describing the performance of the self-dual excited synchronous machine under steady-state operation for the two alternatives of the excitation system have been calculated at different values of the power factor, i.e., the turns ratio of the transformer and the ratio of field currents. The experimental results obtained on a 7.6 kVA induction machine converted to a d-q synchronous machine confirm the validity and accuracy of the analysis and mathematical models developed