A Conceptual Approach to the Analysis of the Modeling Strategies Adopted in Power Systems Stability Studies
(The Small Perturbation Model)

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Abstract - In this paper the concepts interrelating the various state variables in modeling power systems are presented and the results tabulated and analyzed for the purpose of providing the researcher with a comprehensive insight to the field of "power system modeling" practice and a deeper understanding to one of the methods adopted in assessing system stability when subjected to a minor disturbance namely the eigenvalue/vector technique. To this end, a detailed analysis of carefully selected power system configurations is performed and the relevant model is developed. The findings of this analysis are presented in 15 different tables including the results of studying the cases of a single machine connected to an infinite system through a tie line and a multimachine system connected to an infinite bus bar through a power network.

The relation linking the adopted model order to the type of instability under study is focused upon. The cataloging of models in this paper also includes the detailed representation of the lumped spring-mass-dashpot model for simulating rotor dynamics. A simplified model of the generator voltage and speed control loops are also included adopting the single lag transfer function configuration and are integrated to the particular cases suffering from system instability to assess for the possible contribution to their stabilization.

Index Terms- Power System Modeling, Eigenvalues/vector analysis, Series Capacitive Compensation, Self Excited Oscillation, Subsynchronous Resonance, Mechanical Modal interaction.