International Journal of Electrical Power & Energy Systems, vol.33, no.2, pp.347-358, February, 2011.

Formulation, computation and improvement of steady state security margins in power systems. Part II: results

F.M. Echavarren Cerezo; E. Lobato Miguélez; L. Rouco Rodríguez; T. Gómez San Román

Abstract-

A steady state security margin for a particular operating point can be defined as the distance from this initial point to the secure operating limits of the system. Four of the most used steady state security margins are the power flow feasibility margin, the contingency feasibility margin, the load margin to voltage collapse, and the total transfer capability between system areas. This is the second part of a two part paper. Part I has proposed a novel framework of a general model able to formulate, compute and improve any steady state security margin. In Part II the performance of the general model is validated by solving a variety of practical situations in modern real power systems. Actual examples of the Spanish power system will be used for this purpose. The same computation and improvement algorithms outlined in Part I have been applied for the four security margins considered in the study, outlining the convenience of defining a general framework valid for the four of them. The general model is used here in Part II to compute and improve: (a) the power flow feasibility margin (assessing the influence of the reactive power generation limits in the Spanish power system), (b) the contingency feasibility margin (assessing the influence of transmission and generation capacity in maintaining a correct voltage profile), (c) the load margin to voltage collapse (assessing the location and quantity of loads that must be shed in order to be far away from voltage collapse) and (d) the total transfer capability (assessing the export import pattern of electric power between different areas of the Spanish system).

Index Terms- Steady state analysis; Security margins; Power flow feasibility; Contingency analysis; Voltage collapse; Total transfer capability.

Citation:
Echavarren, F.M.; Lobato, E.; Rouco, L.; Gómez, T. "Formulation, computation and improvement of steady state security margins in power systems. Part II: results", International Journal of Electrical Power & Energy Systems, vol.33, no.2, pp.347-358, February, 2011.