

Quantitative frequency security assessment for multi-machine power system based on COI frequency

ABSTRACT

The frequency is one of the instruments for measuring the health status of the power system, due to its ability to anticipate any imbalance between generations and loads. If the generated power is adequate for the system load and losses, then, the system will be in a steady state, otherwise frequency deviates from nominal value due to the mismatch between the generation and load. If the frequency continues to deviate from nominal value, the system may collapse. The assessment of frequency stability level becomes an essential aspect of power system operation and also for projecting the ability of the power system to maintain nominal frequency when subjected to any disturbance. In this paper, a method is proposed to evaluate frequency security of multi-machine power system using transient frequency deviation index (TFDI) which is based on Center of Inertia (COI) referred frequency. The proposed method has been tested on the New England 39- bus test system. Results show that the proposed method takes the advantage of TFDI in accumulating the effect of frequency trajectory deviations. These frequency trajectories may be obtained from the time domain simulation or Wide Area Measurement System (WAMS). The results also show the advantages of COI referred frequency in representing the equivalent frequency of the system. The method would provide a reliable and efficient base for load shedding relays adjustment and operation control.

Keyword: COI frequency; Frequency stability assessment; Transient frequency deviation index; Quantitative security assessment