ANALYSIS OF STEADY AND TRANSIENTS – STATE STABILITY OF TRANSMISSION NETWORK

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ABSTRACT

This paper proposed two scenario, the 1st scenario look at the analysis of transient stability study of 330KV super-grid voltage level of Nigerian power system network. Considering Alaoja (load-bus), Onitsha (load-bus) and Afam power station (generating-bus) referred as study case, from the Nigerian 330KV transmission grid (network) for purpose of investigation and findings. The analysis is based on swing-equation model approach and power transfer capability conditions. The activities of fault initiated were recorded as "sustained fault" classified with respect to time setting of the protective relay and circuit breaker operations from Afam power generating station (GS) to the 330KV network in order to measure the behaviour of the turbine rotor-angle with the clearing time setting of the relay. The collected data were simulated via Matlab platform, with the clearing time setting of (t = 0.0, 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35, 0.40, 0.45, 0.50) corresponding to the respective deviation of the rotor swinging angles of (rf1, rf2, rf3 and rf4). Where rf1 defined the deviation of the rotor-angle of the turbine power plant due to sustained fault condition with time, t. while rf2, rf3, and rf4; defined the restoration ability of the deviated rotor-angle (rf1) from instability to gradual progressive stability condition, with fault cleared at 2.5cycle (rf2), 6.5 cycle (rf3) and 8.25cycle (rf4) respectively. The 2nd scenario also look at the analysis of three (3) phase short-circuit faults including: (phase A, phase B; phase C respectively) in a Matlab coded environment. The results of the simulated fault condition shows that, there is strong need for short –circuit fault-clearing time which should be quick for relay and circuit breaker responses (sensitivity and selectivity- based). The revelation of the finding also shows that system instability will be restored for improvement at fault clearing time before 0.05s. Evidently, further work will look at the investigation of incremental loading condition of the turbine power plant.

Keywords: Transient stability, swing-equation, load/rotor angle, fault, power transfer, transmission grid, protective relaying and circuit breaker.