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***Abstract-* The main objective of this paper is to improve the critical clearing time of the Steel Plant 35 MW Turbo generator. In order to enhance the transient behavior of the system, Power System Stabilizer is added so that proper damping is done.**

Damping intra area and inter area oscillations are critical to optimal power flow and stability on a system. Power system stabilizer is an effective damping device, as they provide auxiliary control signals to the excitation system of the generator.

Transient stability analysis was carried out for the Steel plant. The three phase to ground and line to ground fault was simulated. The critical clearing time was found to be more when Power System Stabilizer was added and when Power System Stabilizer was not added the critical clearing time has considerably reduced.

Keywords-power system stabilizer, ETAB, load flow analysis, transient stability, short circuit stability

I INTRODUCTION

In power systems, reliability and transfer capability are often limited by stability constraints like transient, oscillatory, and voltage stabilities. Maintaining system stability presents new challenges, as power systems are operating today under more stressed conditions and uncertainty than in the past. If stability problems are accurately identified and properly mitigated, significant economic gains can be realized. Power system stabilizers (PSSs) are used as supplementary control in ETAP, first the single line diagram was drawn. Parameters were given accordingly and load flow, short devices to provide extra damping and improve the dynamic performance of the power system. PSSs are very effective controllers in enhancing the damping of low-frequency oscillations because they can increase the damping torque for inter area modes by introducing additional signals into the excitation controllers of the generators. These oscillations come into existence when generators fall out of step from each other. Depending on their location in the system, some generators participate in a single mode of oscillation, whereas others participate in more than one mode.

Researchers have been putting lots of efforts in the design of optimal PSSs to satisfy different system requirements. Several PSS design techniques have been reported. These algorithms employ large number of particles or individuals in the optimization. The involvement of large number of particles takes a significant amount of computation time. This may pose a serious problem for systems which desire faster convergence.

II ETAP MODELING

ETAP is software where we can simulate power system components .In this paper, the burden on time is reduced and the simulation is as quick as possible. For the steel plant, first load flow analysis has been performed. The different voltage profile , real and reactive power injected to the system has been found then short circuit analysis is performed for three phase fault and single phase to ground fault , the short circuit current is noted .then transient stability analysis is noted and the plots have been shown. Here circuit and transient stability were performed. In this paper the steps involved for analysis of steam plant using ETAP modeling is illustrated below.

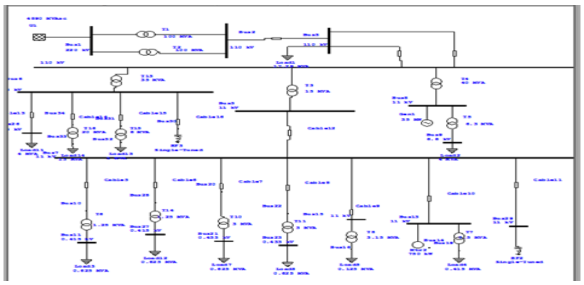

Figure 1 One line diagram (OLVI)

To avoid burden on time and resources, the need for developing a system which runs quickly has to be developed.

III SINGLE LINE DIAGRAM USING ETAP

Figure 1 shows the steam plant consisting of 35MW turbo Generator, transformer rating with 100, 15 and 45 MVA, the transmission line consists of Panther and Lynx Conductors, and there exists shunt reactors, cables and the motor rating of 750 KW. In this load flow analysis is done in two cases, the first case consists of grid voltage with different voltage rating and the second case tells about the cogeneration. These are simulated using ETAP software, and the results are generated without any oscillation in the signals. For the different voltage profile, the stability of the bus is checked i.e., the different rating for the grid, buses were given and the changes were noted.

IV LOAD FLOW ANALYSIS

Load flow analysis of steam plant in done with two cases, the first case determines the grid voltages with different rating such as grid voltage at 200,220,235Kv. The second case explains the cogeneration.

For each load or voltage change, load flow is run and the different real and reactive power was observed for each and every bus connected to the grid. In this cogeneration plays a key role were part of the power is through arcing through high amount of power which is being supplied to the grid. Now when more amount of power is supplied there comes the concept of power export mode (where excess power is supplied to the grid). When the load draws more power, then from the grid the power is drawn and it's being supplied to the load.

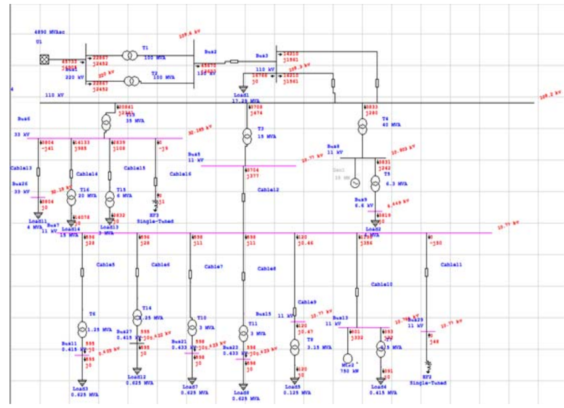

Figure 2 Cogeneration-out of service

When power is imported/exported, the real and reactive power changes therefore the voltage at each bus has to be in the required profile failing to which the bus would be unstable. Each and every time these stated measures have to be noted**.**

V SHORT CIRCUIT STABILITY

Two faults have been considered in this paper is single line to ground fault and three phase fault has been applied. By performing the short circuit test, fault current is found out and for all the two faults the fault current is noted. Randomly the bus is considered to be faulted and different fault current is noted for three phase fault and single line to ground fault.

Faulted bus	Voltage	Fault current
BUS 1	220 kV	1.59kA
BUS 3	110 kV	6.26 kA
BUS 6	33 kV	5.56kA
BUS 9	11 kV	5.68kA
BUS 18	6.6 kV	8.18kA
BUS 22	415V	38.6kA

Figure 3 Single line to ground fault analysis

Voltage	Faulted bus	Fault current
220 kV	BUS 1	13.2kA
110 kV	BUS 3	6.1 kA
33 kV	BUS 6	5.1kA
11 kV	BUS 9	5.5kA
6.6 kV	BUS 18	7.9kA
415V	BUS 22	36.2kA

Figure 4 Three phase fault analysis

VI TRANSIENT STABILITY

In this case of transient stability, the fault is given and here the power system stabilizer was not added so it is observed that there are oscillations, if these oscillations prevail the voltage will not be stable and the system will become unstable soon.

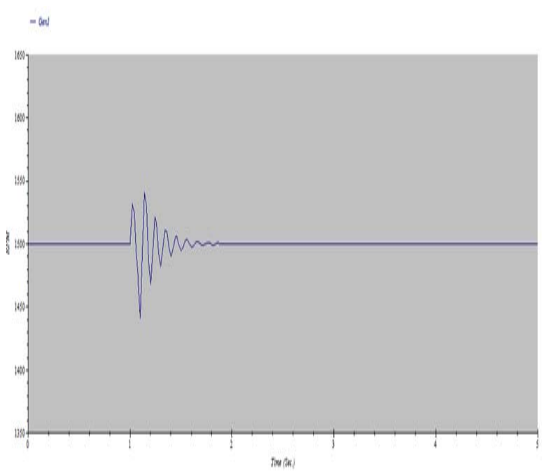

Figure 5 Transient stability analysis without power system stabilizer

In next case, the power system stabilizer is added so that the oscillations are much reduced and here the voltage is in the permissible limit. Whatever high amount of fault given the system would be stable. The critical clearing time was found to be 1.02 seconds when PSS was not added.

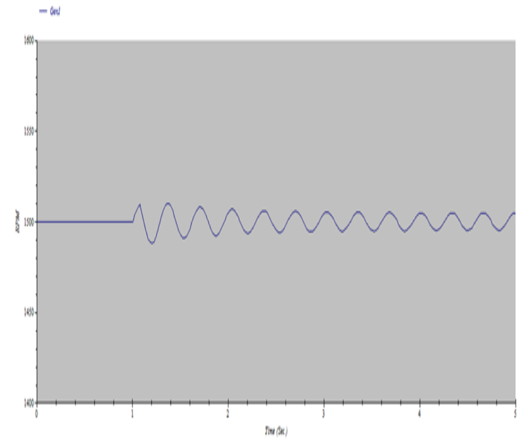

Figure 6 Transient stability analysis with power system stabilizer

The below diagram shows that the speed response in clearing the fault, when power system stabilizer was added to the system. The response is as quick as possible by using a optimized power system stabilizer. The critical clearing time was found to be 1.08 seconds and it is the optimized result.

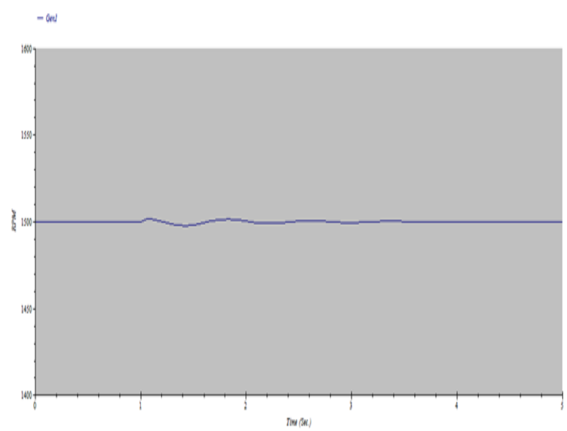

Figure 7.Optimized power system stabilizer graph

VIII CONCLUSION

In this paper, the critical clearing time was improved by using the optimized power system stabilizer and the steel plant is said to be stable after checking for load flow, short circuit and transient stability analysis. The critical clearing time is found to be 1.08 seconds. Further improvisation is by analyzing the state grid of a country with the help of the sufficient data.

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