Handout no.10

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Reg. No	2019-EE-373, 381, 383
Marks/Grade	

EXPERIMENT NO. 10

Perform transient stability analysis of generators for calculating the critical angle.

Objective:

At the end of this lab session students will be able

- To accurately select the rotor angle of generator for calculating the critical angle, and stability of system.

Introduction:

Transient stability involves the response to large disturbances, which may cause rather large changes in rotor speeds, power angles and power transfers. Transient stability is a fast phenomenon usually evident within a few second. Power system stability mainly concerned with rotor stability analysis.

$$P_e = P_d = \frac{|E_g||V_t|}{x_d}\sin\delta$$

$$= P_{max}\sin\delta \quad (38)$$

Where $|E_g|$ is the rms internal voltage, $|V_t|$ is the rms terminal voltage, x_d is the direct axis reactance (or the synchronous reactance in a round rotor machine) and δ is the electrical power angle.

To find the critical time for stability of power system

$$t = \sqrt{\frac{4H}{\omega_{syn} P_{mp.u.}}(\delta(t) - \delta_0)}$$

Setting and results of power diagrams:

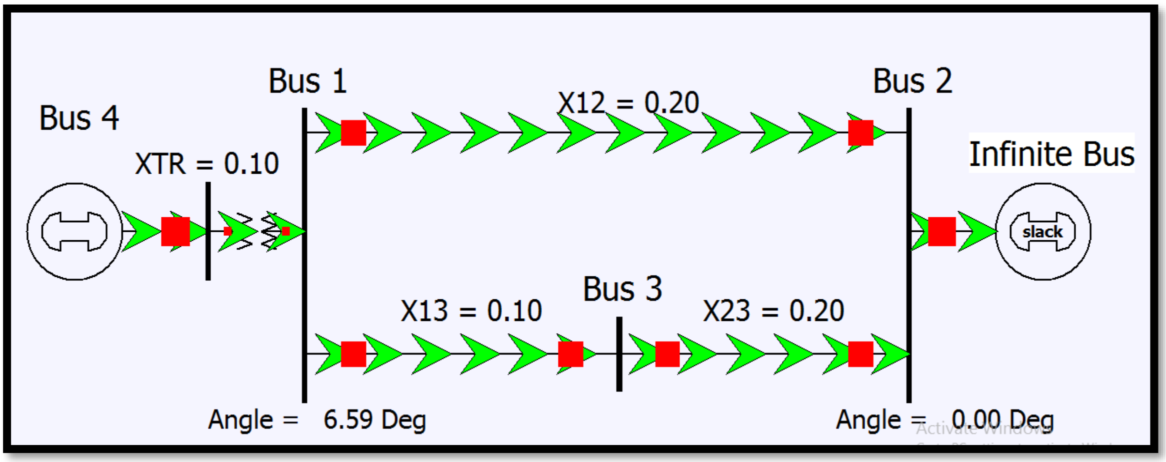

Figure10.1: Two bus power system in PWS

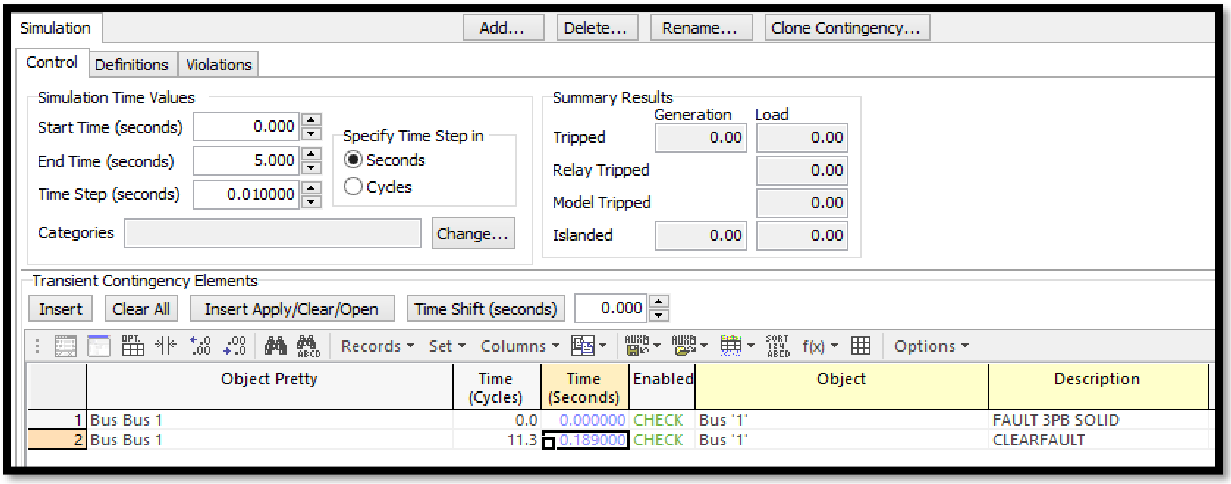

Figure10.2: Set the time at (t=0.1890sec)

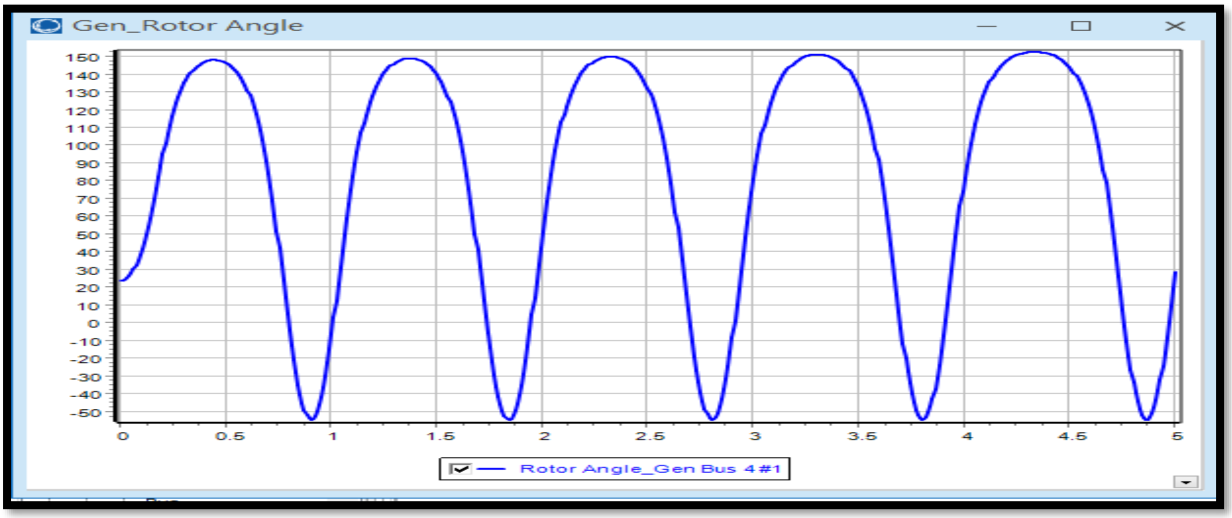

Figure10.3: Generator rotor angle curve at time 0.1890sec and it is stable

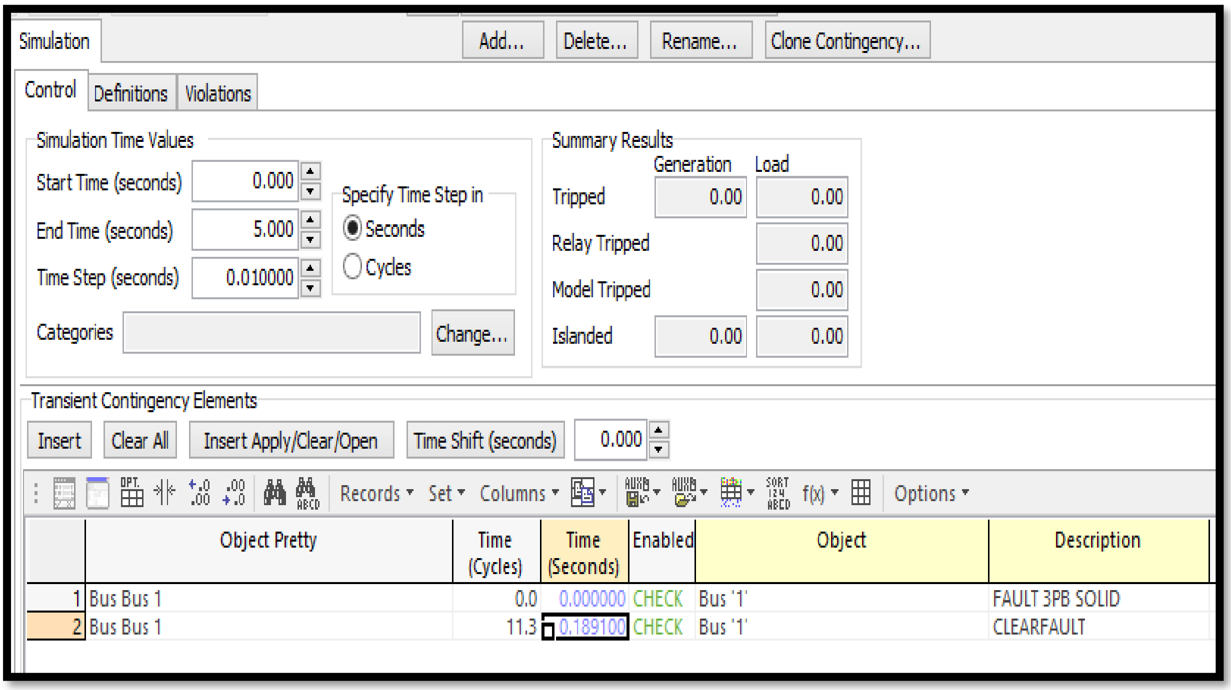

Figure10.4: Set time at t=0.1891sec

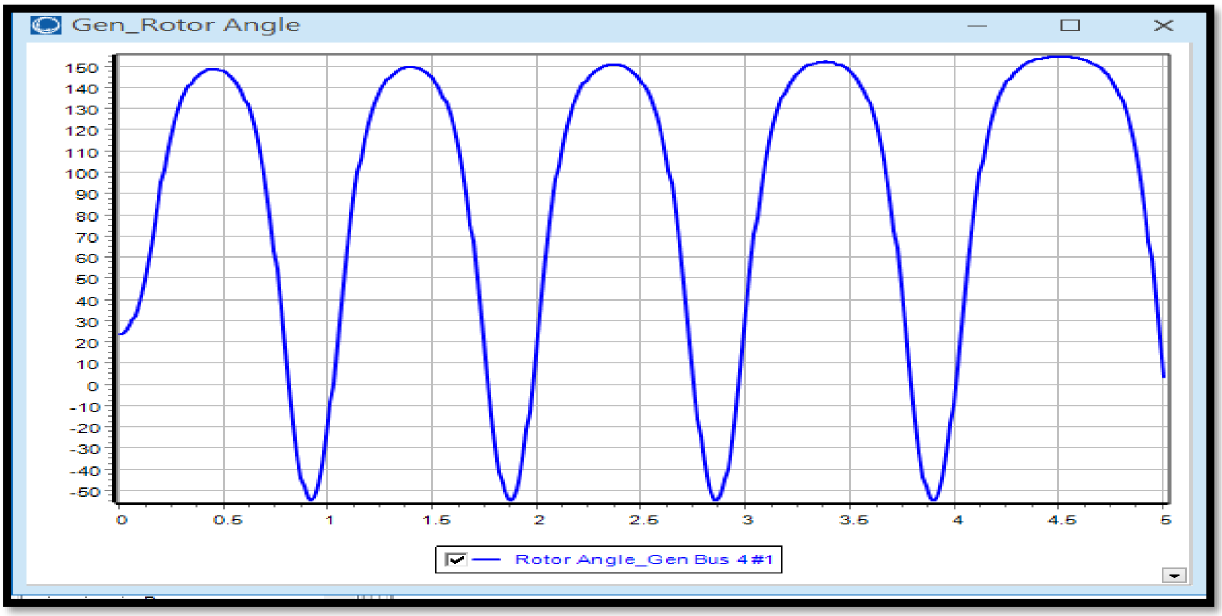

Figure10.5: Generator rotor angle curve at time 0.1891sec and at this time it is stable.

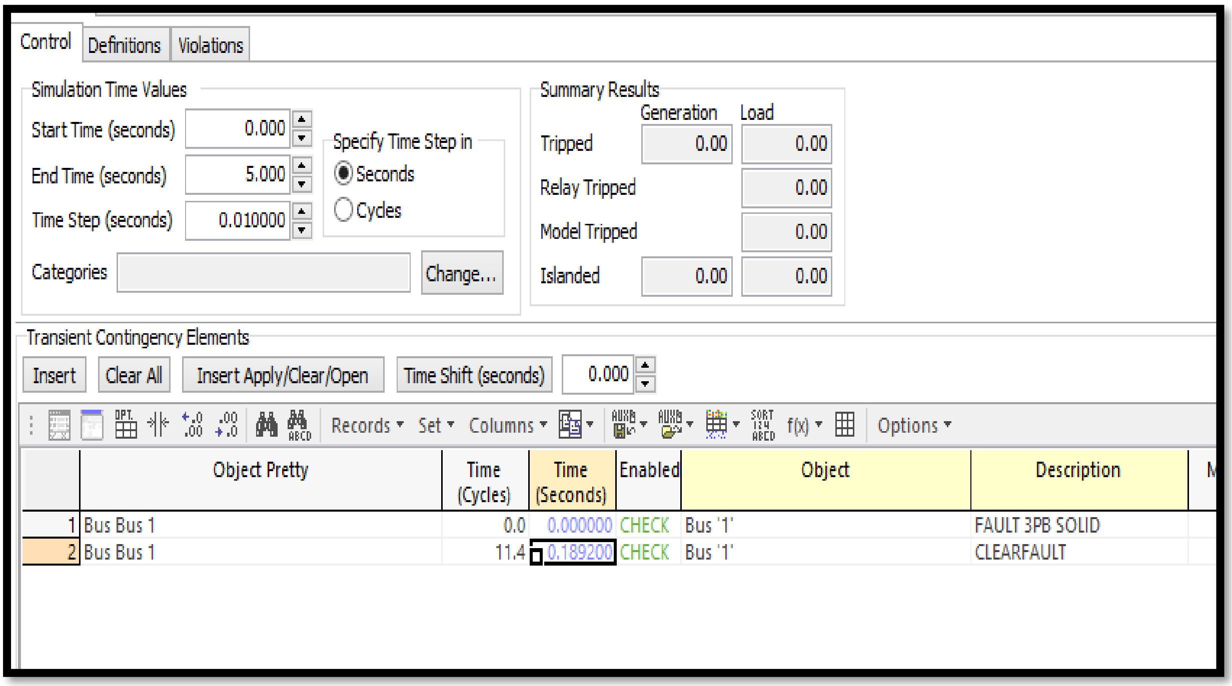

Figure10.6: Set time at t=0.1892sec

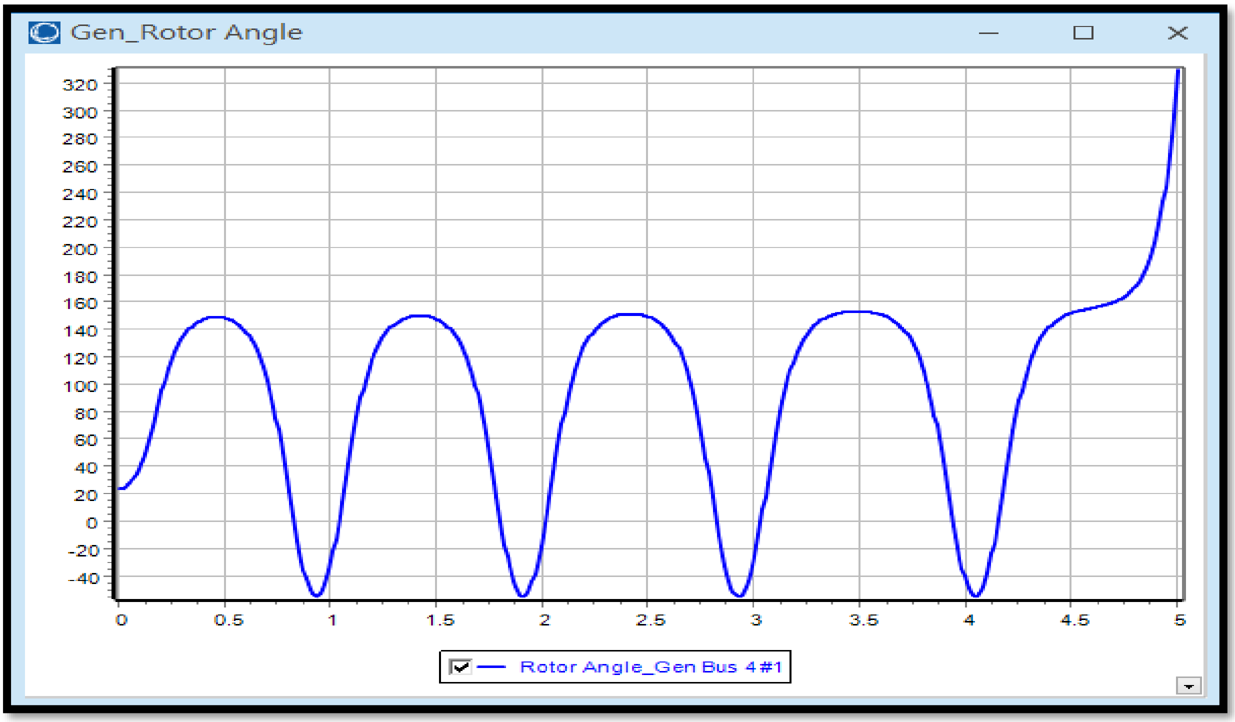

Figure10.7: Generator rotor angle curve at time 0.1892sec and at this time it lead toward instability.

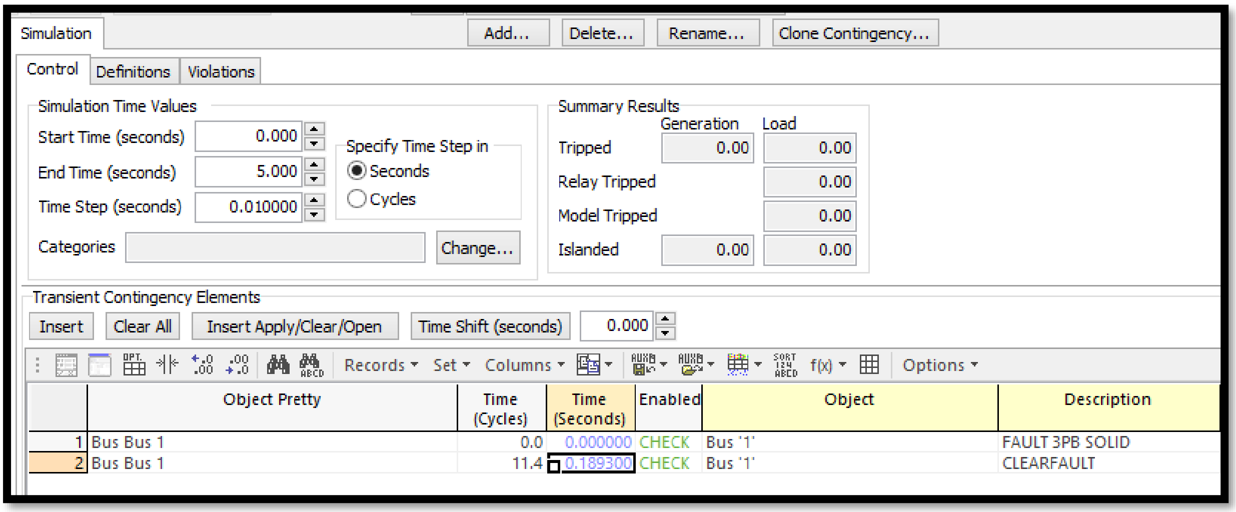

Figure10.8: Set time at t=0.1893sec

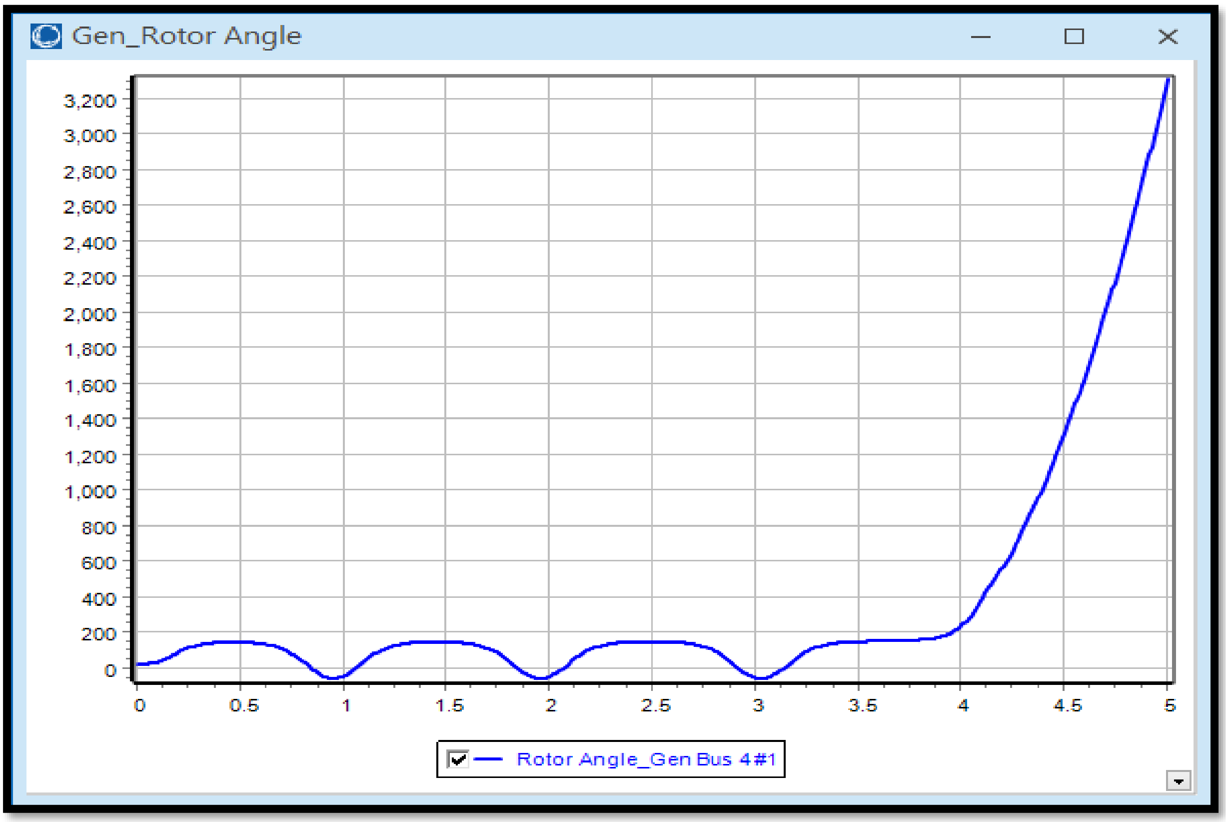

Figure10.9: Generator rotor angle curve at time 0.1893sec and at this time it leads toward instability.

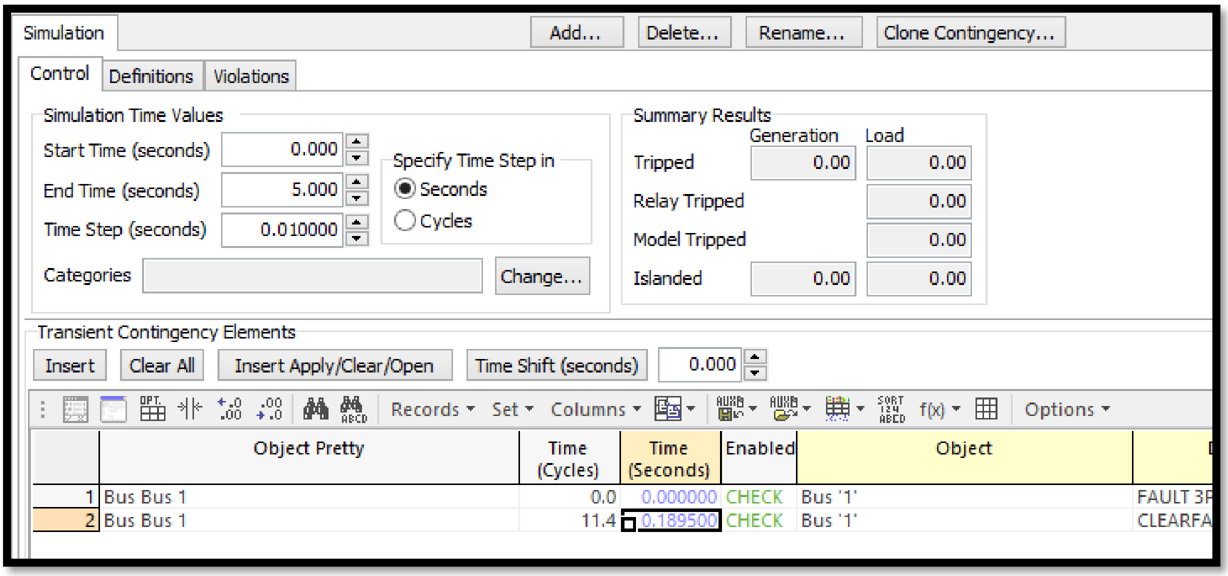

Figure10.10: Set time at t=0.1894sec

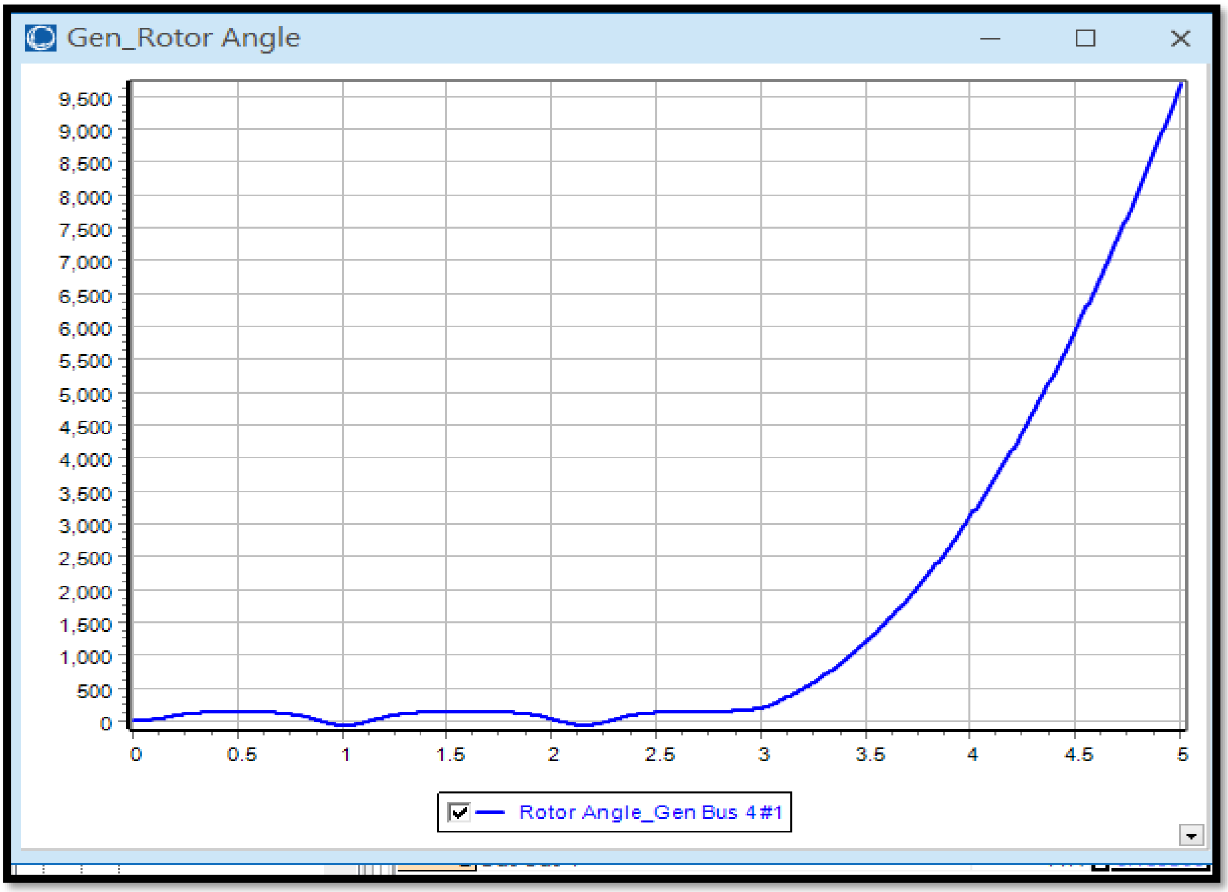

Figure10.11: Generator rotor angle curve at time 0.1894sec and at this time it is unstable.

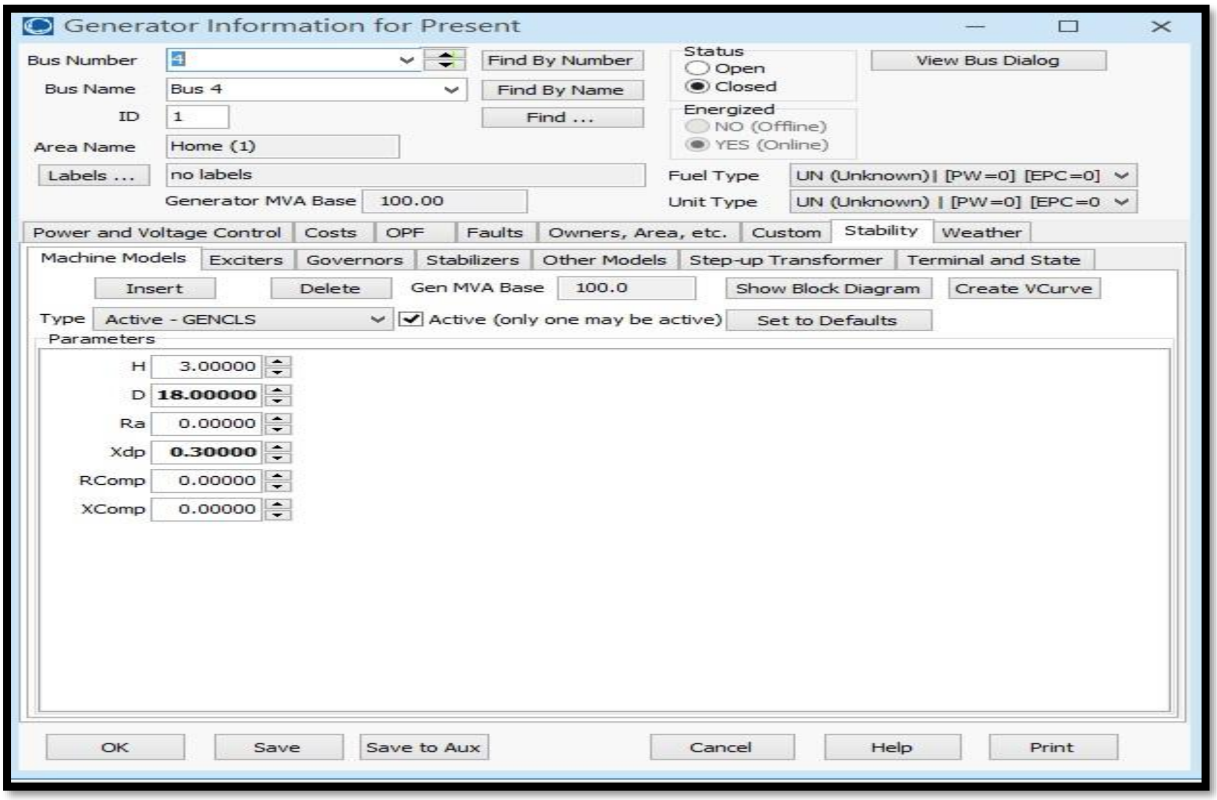

Figure no.10.12: Setting of the damping factor at 18 from generator stability tab

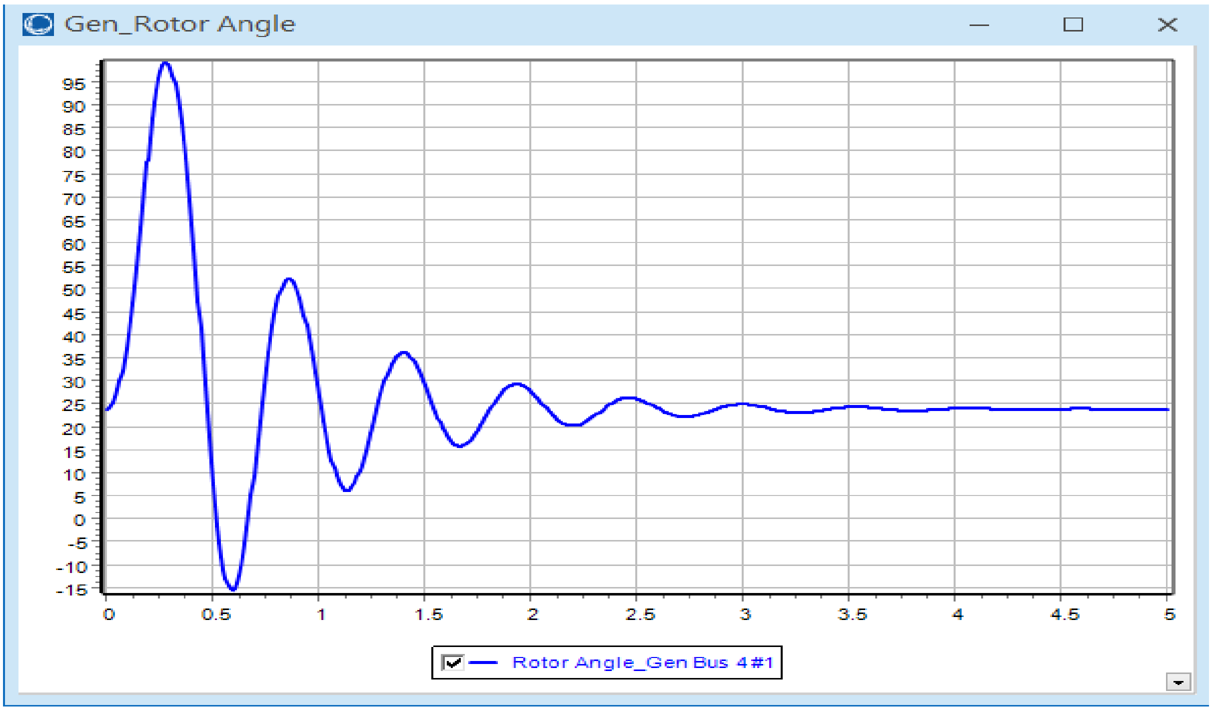

Figure10.13: Generator rotor angle curve at time 0.1891sec while damping factor of generator is D=18.

Observation and Conclusion:

Transient stability analysis is an important process for assessing the stability of a power system under transient conditions. This analysis is used to determine the critical clearing angle, which is the maximum angle between the voltage phasors of two synchronous generators that can be maintained without the system becoming unstable. The transient stability analysis involves simulating the behavior of the power system in response to a disturbance, such as a fault or sudden change in load. The analysis calculates the time-domain response of the system and determines the critical angle beyond which the system loses stability. However, transient stability analysis of generators is crucial for determining the critical clearing angle and ensuring the stability of a power system. This analysis helps to identify potential stability issues and provides valuable information for designing protective relays and other control systems to prevent blackouts and other power system failures.