Indian Institute of Technology Patna
Department of Electrical Engineering
EE549 - Power System Dynamics and Control
Spring - 2021
Quiz - I (Online)
15 February 2021

There are 2 Questions. They carry equal marks.

$(2 \times 10 = 20)$

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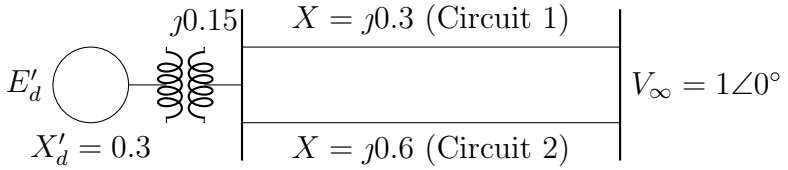
1. Consider a system where a synchronous machine is connected to an infinite bus. The network is purely reactive. The synchronous generator is delivering real power $P = 0.9$ p.u. and reactive power $Q = 0.3$ p.u. to the infinite bus of 1.0 p.u at steady state.



   The synchronous generator is represented by the classical model with the following parameters.

$$X'_d = 0.3 \text{ p.u.}, \quad H = 5 \text{ sec}, \quad D = 0.1$$

   Suppose the circuit 2 is lost which is a small disturbance. Determine the following if $\Delta\delta = 5^\circ$.

   (a) the damped frequency of oscillation.

   (b) the eigen values.

   (c) the time response of rotor angle.

   (d) the time response of rotor speed.

   (e) the time constant.

2. Consider a synchronous machine serving the rated load at 0.9 p.f. lagging and rated terminal voltage. It has $X_d = X_q = 1.5$, $X_{md} = 1.4$ and $R_s = 0.003$.

   (a) Find the air gap torque T_e in p.u.

   (b) Show that P_e and T_e are the same in p.u.