Georgia Institute of Technology
School of Electrical and Computer Engineering

EE4321 **Power System Engineering** **Spring 2009**

Homework Assignment #5
Due March 5, 2009

Problem P1: Consider problem P1 of HW#4. For convenience the problem statement is provided below.

Compute the critical reclosing time for a three phase fault anywhere along the line and assuming that the fault is temporary.

HW#4:

Problem P2: A 3-phase synchronous machine is rated 300 MVA, 60 Hz, 18 kV. The transient reactance of the machine is 0.18 pu. It is connected to a 500 kV infinite bus via an 18 kV/230 kV, wye-wye connected step-up transformer, one 230 kV transmission line and a 230 kV/500 kV wye-wye connected auto-transformer as it is illustrated in Figure P2. The generator delivers at its terminals 250 MVA apparent power at rated terminal voltage and power factor unity.

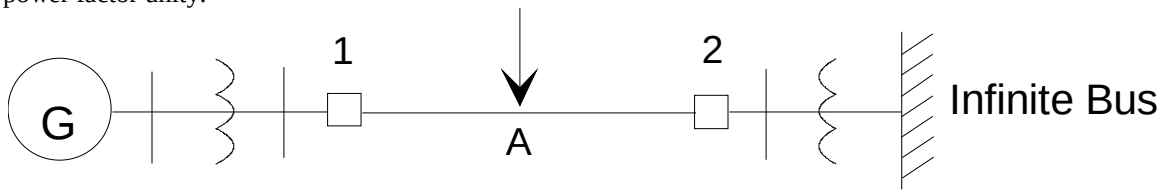

Figure P2

Assume at time t=0 a three-phase fault occurs at a point A along the transmission line. The fault is cleared in 3 cycles or 0.05 seconds by opening the breakers 1 and 2. At time t=0.10 seconds after the breakers opened, the breakers 1 and 2 reclose. Assume that the fault was temporary, i.e. upon reclosing the system is faultless.

(a) Compute the operating conditions of the system prior to the fault.
(b) Compute the generator phase angle as a function of time in the time interval zero to 0.15 seconds.
(c) Compute the lectric power output of the generator immediately after the breakers reclose.

Additional data are:

18 kV/230 kV transformer: Power rating: 300 MVA, $z_1 = j0.07\ pu$ (on its own rating).

Transmission line: Length: 60 miles long, $z_1 = j0.65\,ohms/mile$.

230kV/500kV auto-transformer: Power rating: 300 MVA, $z_1 = j0.06\ pu$ (on its own rating).

Generator: $z_d = j0.18, \quad H = 2.8\ \text{sec}$