ECEN 667 Homework 5
Due on Tuesday Oct 31, 2023

1. Using the **Example 7_4_HW5** PowerWorld Case, determine the critical clearing time for a self-clearing fault at bus 9.

2. Using your results from problem 1, determine the sensitivity of this clearing time to KA value for the exciter at the bus 3 generator and the bus 3 generator initial real power output (when varying the bus 3 generator MW output assume the change in generation is made up at the system slack).

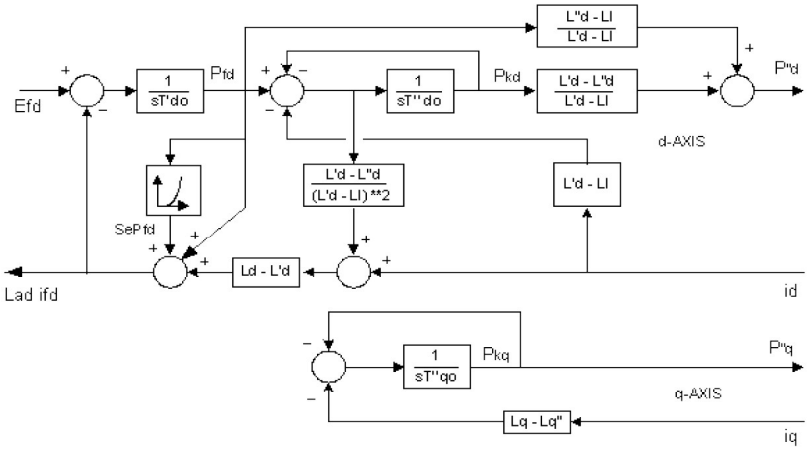
3. Assume a 60 Hz, 100 MVA base synchronous generator is represented with a classical model with per unit values of H = 5.0, D = 1, and $X_d' = 0.25$. Assume the generator is supplying 100 MW and 25 Mvar to a $1.0\angle 0°$ infinite bus (measured at the infinite bus) through a transmission line with per unit (100 MVA base) impedance of 0.05 + j0.25. If at t=0 a solid three phase fault is applied to the generator's terminal, using the Forward Euler's method with a time step of 0.01 seconds determine the generator's speed and angle at time = 0.02 seconds.

4. Repeat Problem 3 except using the second order Runge-Kutta method.

5. Repeat Problem 3 except using the implicit Trapezoidal method.

6. A 60 Hz generator is supplying 400 MW (and 0 Mvar) to an infinite bus (with 1.0 per unit voltage) through two parallel transmission lines. Each transmission line has a per unit impedance (100 MVA base) of 0.1j. Assume the generator represented with a GENSAL model with the following parameter values (all per unit, 400 MVA base): H = 5, D = 0, R_s=0, X_d=2.1, X_q=1.5, X'_d=0.3, X''_d=X''_q=0.18, X_l=0.12, T'_{do}=7, T''_{do} =0.035, T''_{qo}=0.05; you may ignore saturation. The GENSAL block diagram is given below

   At time t= 0 one of the transmission lines experiences a balanced three phase short to ground half way down the line from the generator to the infinite bus (i.e., model the line with 1/2 its original impedance on both sides of the fault. The fault is cleared at t=0.02 seconds by opening the faulted line. Using Euler's method with a time step of 0.01 seconds determine the generator's internal angle and per unit speed over the first 0.04 seconds.


Efd
1
sT'do
Pfd
1
sT''do
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L"d - Ll
L'd - Ll
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