ECE 523: Homework #6

Due Session 30 (December 7)

1. A cylindrical rotor, synchronous machine with the machine parameters given below is operating at rated current (1.0 pu) and 85% lagging power factor when a 3 fault occurs at the machine terminals. Compute:

(a) The steady-state voltage E_q behind the synchronous impedance. Plot a phasor diagram showing E_q, V_a (terminal voltage), and I_a

(b) The voltage E" behind the synchronous impedance

(c) The initial symmetrical fault current

(d) The peak symmetrical current after 5 cycles and 10 cycles.

(e) The maximum asymmetrical current after 5 cycles and 10 cycles.

$pu := 1$	$X_d := 1.05pu$	$X''_d := 0.12pu$	$T'_{d0} := 5.6sec$
	$X_q := 1.02pu$	$X''_q := 0.15pu$	$T'_d := 1.1sec$
	$X'_d := 0.23pu$	$X_2 := 0.12pu$	$T''_d := 0.035sec$
	$X'_q := 0.23pu$	$R_a := 0.0055pu$	$T_a := 0.16sec$

2. Repeat problem 1 using the data for the salient pole machine given below.

$X_d := 1.25pu$	$X''_d := 0.24pu$	$T'_{d0} := 5.6sec$
$X_q := 0.75pu$	$X''_q := 0.34pu$	$T'_d := 1.8sec$
$X'_d := 0.37pu$	$X_2 := 0.24pu$	$T''_d := 0.035sec$
$X'_q := 0.75pu$	$R_a := 0.009pu$	$T_a := 0.15sec$

3. A 2000 HP, 4160V, induction motor operates at a slip of 2%, with 93% efficiency at rated load. The machine parameters are given below. Assume a power factor of 0.85 lagging at rated conditions. Do the following:

(a) Sketch the positive and negative sequence equivalent circuits using the machines ratings as a base.

(b) Convert the equivalent circuits of part A to a 4160V, 100MVA base

(c) Compute the initial fault current provided by the machine to a 3 phase fault at the motor terminals (rated prefault voltage at the terminals and rated load).

(d) Repeat part C for a LL fault

$R_s := 0.02pu$ $X_s := 0.075pu$ $R_r := 0.02pu$ $X_r := 0.075pu$ $X_m := 3.0pu$