

Department of Electrical and Computer Engineering
Breadth Exam / Comprehensive Exam

Problems 2/3/4

TTG Area: Power Systems

ECGR 4142: Power System Analysis II

As shown in the one-line diagram below, two synchronous machines are connected through 3-phase transformers to the transmission line. The ratings and reactances of the machines, transformers, and transmission line are:

Machines 1 and 2: 100 MVA, 20 kV $X_d'' = X_1 = X_2 = 0.2$, $X_0 = 0.04$, $X_n = 0.05$

Transformers T_1 and T_2 : 100 MVA, 20Y / 345Y kV (grounded Y to grounded Y) $X = 0.08$

Transmission Line: $X_1 = X_2 = 0.15$, $X_0 = 0.5$ (on a 100 MVA, 345 kV base)

- a) Draw the positive, negative, and zero sequence networks for this system.
- b) The system is operating at a pre-fault voltage $V_f = 1 \angle 0^\circ$ without pre-fault currents when a fault occurs at bus 3. Reduce the sequence networks to their Thevenin equivalents as viewed from the fault location (bus 3).
- c) Assume the fault in b) is a bolted ($Z_f = 0$) single line-to-ground fault on phase A (at bus 3). Draw the circuit you would be analyzing to perform fault analysis for this type of fault and determine:
 - o **c.1** the fault current to ground, and
 - o **c.2** the line-to-ground voltages at the fault bus.

