ECE 3600 homework DD Go to ME Design day in the Union, , Due next day

Name: ______________________ ECE 3600 homework LF2 a

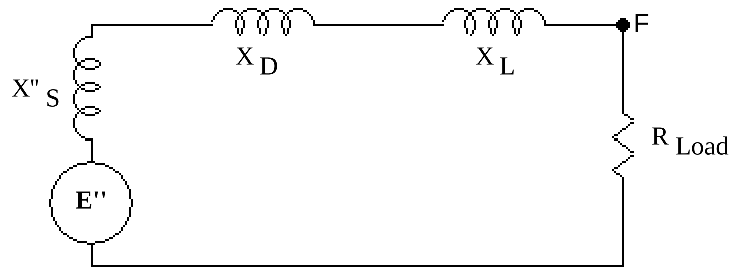
May be submitted Sat., 12/9 for full credit

1. One phase of a balanced 3-phase system is shown here.

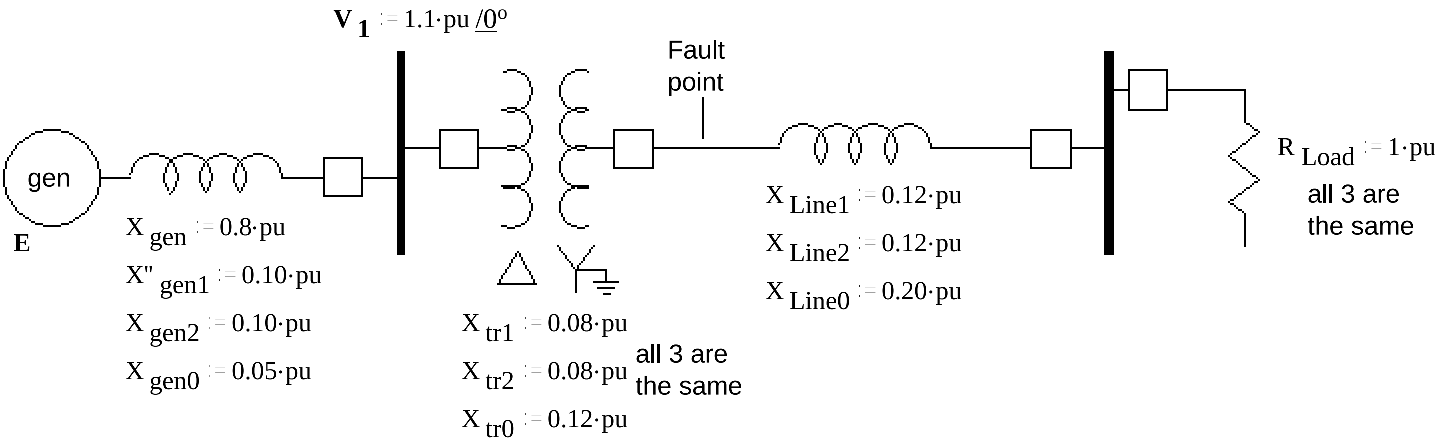
   A fault occurs point F. It is a short between lines b and c with an impedance of $\mathbf{Z_f}$.

   a) Draw the circuit you would have to analyze to find the fault current. Identify the parts and Include the component voltages and currents at the fault.

   b) Set up a mathematical expression (or expressions) to find the fault current. (don't forget j & that the fault current is NOT $\mathbf{I}_{A1}$)



2. Consider this power system. Same as the example in the notes, except for $\mathbf{V_1}$ and X_{tr0} .



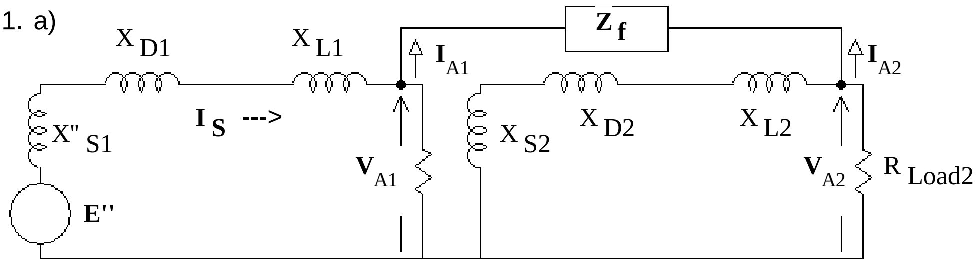
There is a phase-A single-line to ground (SLG) fault with a fault impedance of $\mathbf{Z_f} := 0.15 \cdot pu \; \underline{/0^o}$

Find the fault current. You may be able to use some numbers already calculated in the example

More room on next page ==>

Answers

1. a)



2. $4.69 \cdot pu\ \angle -45.7^\circ$

3. $5.016 \cdot pu\ \angle -46.85^\circ$

b) define

$$\mathbf{Z_X} = \mathbf{Z_f} + \frac{1}{\dfrac{1}{(X_{S2} + X_{D2} + X_{L2}) \cdot j} + \dfrac{1}{R_{Load2}}}$$

$$\mathbf{I_S} = \frac{\mathbf{E''}}{(X''_{S1} + X_{D1} + X_{L1}) \cdot j + \left(\dfrac{1}{\dfrac{1}{R_{Load1}} + \dfrac{1}{\mathbf{Z_X}}}\right)}$$

$$\mathbf{V}_{A1} = \mathbf{I_S} \cdot \frac{1}{\left(\dfrac{1}{R_{Load1}} + \dfrac{1}{\mathbf{Z_X}}\right)}$$

$$\mathbf{I}_{A1} = \frac{\mathbf{V}_{A1}}{\mathbf{Z_X}}$$

$$\mathbf{I_{fault}} = \mathbf{I_B} = \mathbf{a}^2 \cdot \mathbf{I}_{A1} + \mathbf{a} \cdot \mathbf{I}_{A2} = (\mathbf{a}^2 - \mathbf{a}) \cdot \mathbf{I}_{A1} = \sqrt{3}\ \angle -90^\circ\ \mathbf{I}_{A1}$$

3. Repeat problem 2 if before the fault, the load was zero, that is, $\mathbf{P_{Load}} = 0$ and $R_{Load} := \infty$

   hint: this problem is considerably easier now