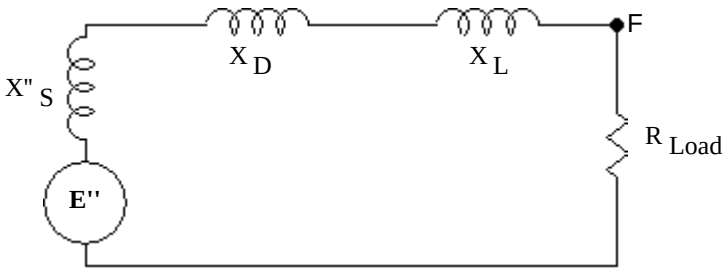
ECE 3600 homework DD Go to ME Design day in the Union, Tue, 12/3, Due Wed, 12/4

Name: _____ ECE 3600 homework LF2 Due: Thur, 12/5/24 a

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

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

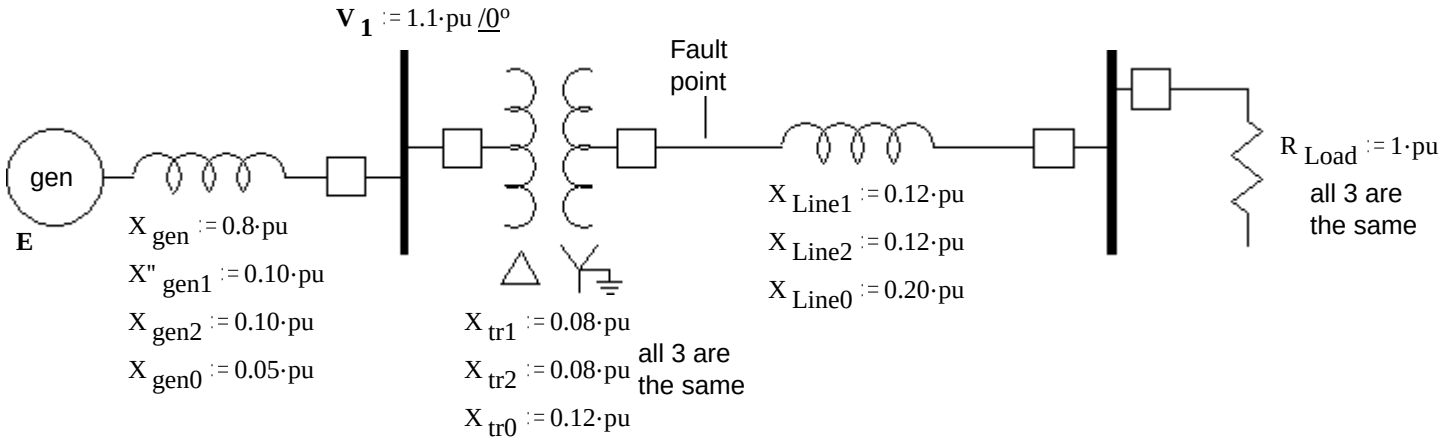


A fault occurs point F. It is a short between lines b and c with an impedance of $\mathbf{Z_f}$.

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} .

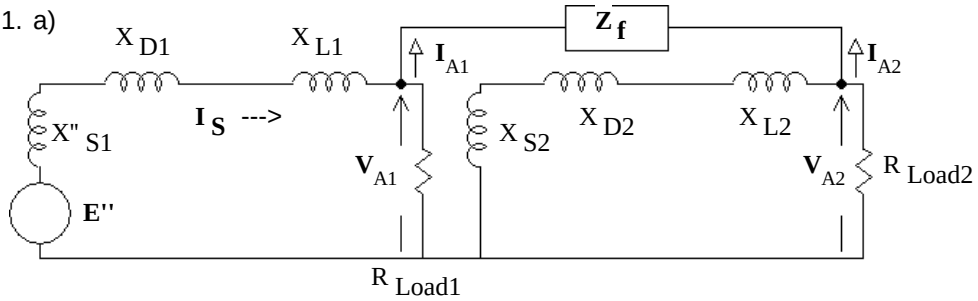


There is a phase-A single-line to ground (SLG) fault with a fault impedance of $\mathbf{Z_f} := 0.15 \cdot pu \quad /0^o$

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

Answers

1. a)



2. 4.69·pu /-45.7°
3. 5.016·pu /-46.85°

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

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

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

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

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