KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

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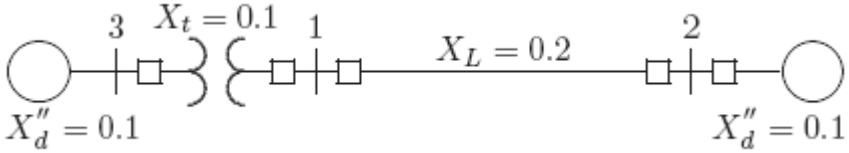
EE-463

Key Solution

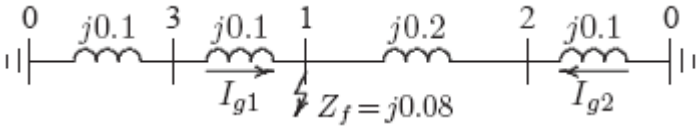
Quiz 3 ser#: I.D.: Name:

The one-line diagram of a simple power system is shown below. All impedances are expressed in per unit on a common MVA base. The generators are operating on no load at their rated voltage with their emfs in phase. A three-phase fault occurs at bus 1 through a fault impedance of $Z_f = j0.08$ per unit.
(a) Calculate the subtransient fault current in per unit.
(b) Determine the bus voltages during the fault.



Solution:

The impedance diagram is as shown below



(a) Impedance to the point of fault is

$$X = j\frac{(0.2)(0.3)}{0.2+0.3} = j0.12 \text{ pu}$$

The fault current is

$$I_f = \frac{1}{j0.12 + j0.08} = 5\angle -90^\circ \text{ pu}$$

(b)

$$V_1 = (j0.08)(-j5) = 0.4 \text{ pu}$$
$$I_{g1} = \frac{j0.3}{j0.5}(5)\angle -90^\circ = 3\angle -90^\circ \text{ pu}$$
$$I_{g2} = \frac{j0.2}{j0.5}(5)\angle -90^\circ = 2\angle -90^\circ \text{ pu}$$
$$V_2 = 0.4 + (j0.2)(-j2) = 0.8 \text{ pu}$$
$$V_3 = 0.4 + (j0.1)(-j3) = 0.7 \text{ pu}$$