KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE-520 (171)

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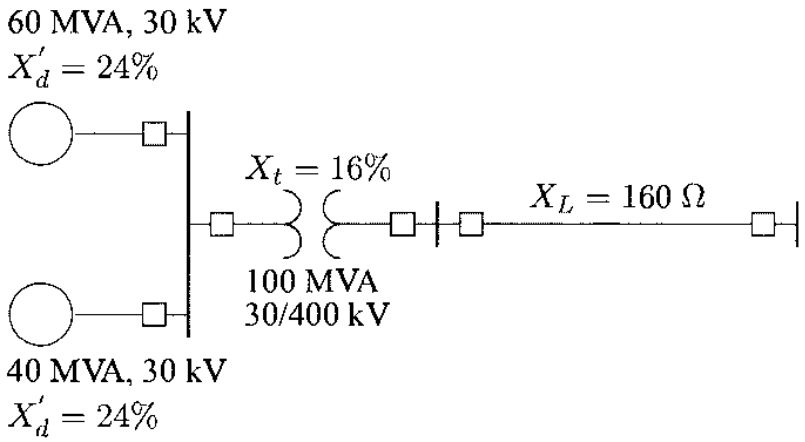
Home Work 4

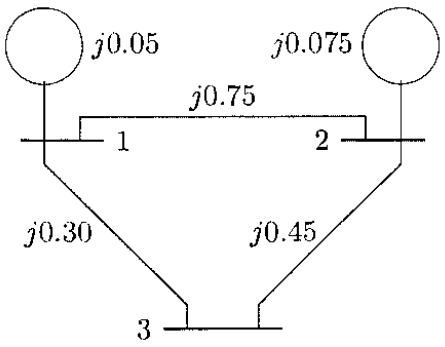
Q.1) The system shown below is initially on no load with generators operating at their rated voltage with their emfs in phase. The rating of the generators and the transformers and their respective percent reactances are marked on the diagram. All resistances are neglected. The line impedance is *j*160 Ohm. A three-phase balanced fault occurs at the receiving end of the transmission line. Determine the short circuit current and the short-circuit MVA.



Q.2) The one-line diagram of a simple three-bus power system is shown below. Each generator is represented by an emf behind the subtransient reactance. All impedances are expressed in per unit on a common MVA base. All resistances and shunt capacitances are neglected. The generators are operating on no load at their rated voltage with their emfs in phase. A three-phase fault occurs at bus 3 through a fault impedance of $Z_f = j0.19$ per unit.

a. Use circuit analysis to determine the bus voltages and line currents during fault.

b. Use the bus impedance matrix to calculate the bus voltages and line currents during fault.



Q.3) The operator *a* is defined as $a = 1 < 120^o$, drive the formulation for the following relationship:

a. The positive-sequence of phase voltage V_{an} in terms of the positive-sequence of line voltage V_{bc}.

b. The negative-sequence of phase voltage V_{an} in terms of the negative-sequence of line voltage V_{bc}.

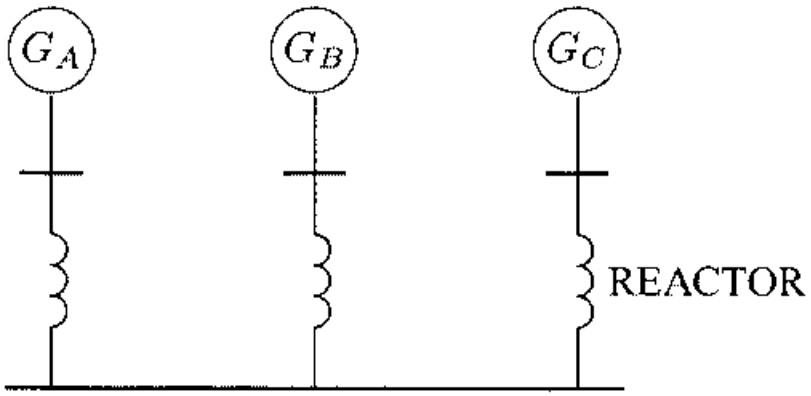
Q.4) The line-to-line voltages in an unbalanced three-phase supply are $V_{ab} = 1000 < 0^o$, $V_{bc} = 866 < 150^o$, and $V_{ca} = 500 < 120^o$. Determine the phase voltages *Van*, *Vbn*, and *Vcn*.

Q.5) Three 15-MVA, 30-kV synchronous generators A, B, and C are connected via three reactors to a common bus bar, as shown below. The neutrals of generators A and B are solidly grounded, and the neutral of generator C is grounded through a reactor of 2.0 Ohm. The generator data and the reactance of the reactors are tabulated below. Neglect prefault currents and assume generators are operating at their rated voltage. Determine the fault current for the following:

a. A bolted line-to-ground fault occurs on phase *a* of the common bus bar.

b. A bolted line-to-line fault occurs on between phase *b* and phase *c* of the common bus bar.

c. A bolted double line-to-ground fault occurs on phases *b* and *c* of the common bus bar.



Item	X^1	X^2	X^0
G_A	0.25 pu	0.155 pu	0.056 pu
G_B	0.20 pu	0.155 pu	0.056 pu
G_C	0.20 pu	0.155 pu	0.060 pu
Reactor	6.0 Ω	6.0 Ω	6.0 Ω