SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

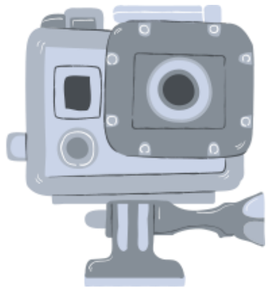
Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

UNIT 4

Fault Analysis – Balanced Faults

19EET302 – Power System 1
III year / V Semester



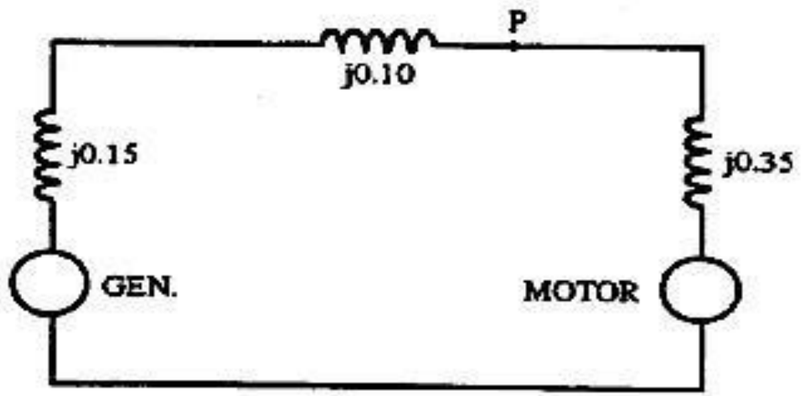
Problem formulation on Synchronous Machine

Fault Analysis

Problem

A generator is connected through a transformer to a synchronous motor. Reduced to the same base, the per-unit subtransient reactances of the generator and motor are 0.15 and 0.35, respectively, and the leakage reactance of the transformer is 0.10 per unit. A three-phase fault occurs at the terminals of the motor when the terminal voltage of the generator is 0.9 per unit and the output current of the generator is 1.0 per unit at 0.8 power factor leading. Find the subtransient current in per unit in the fault, in the generator and in the motor. Use the terminal voltage of the generator as the reference phasor and obtain the solution (*a*) by computing the voltages behind subtransient reactance in the generator and motor and (*b*) by using Thévenin's theorem.

Solution:



P: fault point

(*a*)

Solution

(a)

$$E_g'' = 0.9 + (0.8 + j0.6)(j0.15) = 0.81 + j0.12 \text{ per unit}$$
$$E_m'' = 0.9 - (0.8 + j0.6)(j0.45) = 1.17 - j0.36 \text{ per unit}$$
$$I_g'' = \frac{0.81 + j0.12}{j0.25} = 0.48 - j3.24 \text{ per unit}$$

$$I_m'' = \frac{1.17 - j0.36}{j0.35} = -1.03 - j3.34 \text{ per unit}$$
$$I_f'' = I_g'' + I_m'' = -0.55 - j6.58 \text{ per unit}$$

(b)

$$V_f = 0.9 - (0.8 + j0.6)(j0.1) = 0.96 - j0.08 \text{ per unit}$$
$$Z_{th} = \frac{j0.25 \times j0.35}{j0.60} = j0.146 \text{ per unit}$$
$$I_f'' = \frac{0.96 - j0.08}{j0.146} = -0.55 - j6.58 \text{ per unit}$$

By replacing I_f'' by a current source and then applying the principle of superposition,

$$I_g'' = 0.8 + j0.6 + \frac{j0.35}{j0.60}(-0.55 - j6.58) = 0.48 - j3.24 \text{ per unit}$$
$$I_m'' = -0.8 - j0.6 + \frac{j0.25}{j0.60}(-0.55 - j6.58) = -1.03 - j3.34 \text{ per unit}$$

Summary

Activity

KEEP
LEARNING..

Thank u

SEE YOU IN NEXT CLASS