KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT
EE-462   ELECTRICAL MACHINES

Term: 012

Experiment # 3
SLIP TEST FOR DETERMINING X_d & X_q OF SYNCHRONOUS MACHINES

⊟⊡ INTRODUCTION

It is common to represent the synchronous machine by an equivalent circuit of series-connected inductance with constant emf. Such representation may lead to an appreciable error because of the effect of saliency of poles. The saliency of the poles means that the rotor has different electric and magnetic characteristics in its two perpendicular axes, the direct and quadrature axes.

⊟⊡ OBJECTIVE

To determine the direct- and quadrature- axis reactances of a 3-phase salient-pole synchronous machine.

⊟⊡ PROCEDURE

1. Connect the circuit as shown in figure 1 keeping switches S_1 and S_2 open.
2. Drive the synchronous machine to a speed slightly different from the synchronous value.
3. Close the switch S_2 to excite the synchronous machine and check the phase sequence of the generated voltage at the machine terminals.
4. Increase the output voltage of the variac to about 15–25% of the rated value of the synchronous machine, and check the phase sequence of that output.
5. Open switch S_2 to interrupt the excitation current and close switch S_1 to apply the output of the variac to the machine armature.

Be sure that the sequence is the same on both sides of switch S_1 before closing it. This will ensure that the armature mmf and the rotor rotate in the same direction.

6. Observe the oscillation of the ammeter (indicating the armature) and the voltmeter (indicating the emf E_f induced in the rotor winding) between a minimum and a maximum.

From your measurement, estimate the representative values of X_d and X_q of the machine.

$X_d =$ ohms and $X_q =$ ohms.

Fill out the following tables:

A. Variac voltages 15% of the rated value

Machine speed (RPM)	1750	1700	1650
X_d ohms			
X_q ohms			

B. Variac voltages 25% of the rated value

Machine speed (RPM)	1750	1700	1650
X_d ohms			
X_q ohms			

Figure 1 of experiment 3:

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