

Load characteristics of Synchronous Generator

Object: The object of this experiment is to run the synchronous machine as a generator and determine the load characteristic as: $U_L = f(I_L)$.

Theory: The excited field has been set in rotation induces a sinusoidal voltage in the stator winding. If the synchronous generator previously excited in no – load is now loaded, the generated voltage is reduced considerably which means that the exciting power must be constantly adapted to the load of the generator. The exciting power must therefore be controlled. Voltage and frequency must be kept constant or adapted to the load. Figure (43) shows the load characteristics (control characteristics) of a synchronous generator operation. At constant exciting current and controlled operation, the output voltage depends on the type of load. To obtain a constant voltage, the excitation at resistive load must be low, at inductive load relatively high and at capacitive load only slightly reduced.

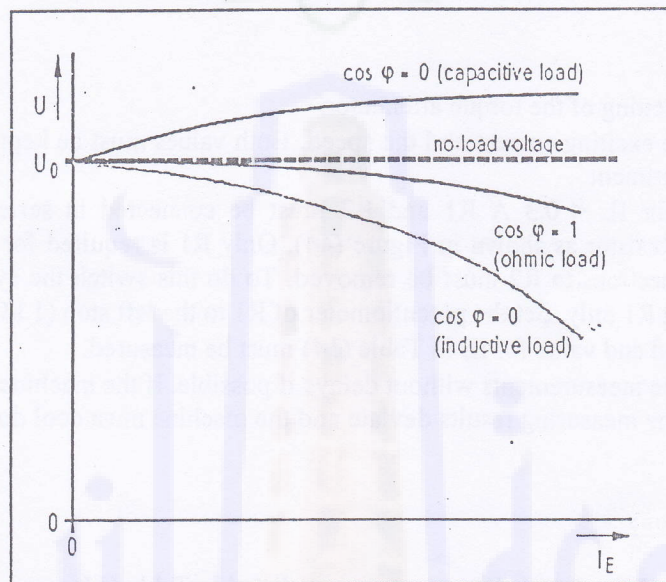


Figure (43)

Load characteristics of Synchronous generator

Necessary equipments:

1. Synchronous Machine (Type 2711).
2. Brake Unit (Type 2719).
3. Control Unit (Type 2730).
4. Universal Power Supply (Type 2740).
5. Universal Resistor (Type 2750).
6. 2 Ammeters, range (0 – 5 A).
7. Voltmeter, range (0 – 1000) V.

Procedure:

1. Connect the circuit shown in Figure (44).
2. Start up the system as already described in the previous experiment. The machine should rotate to the right (CW).
3. Set the speed to the rated speed (1500 rpm), and the exciting field current to (0.95 A).
4. Set the potentiometer of the load resistor (R1) to the left stop (1 K Ω).
5. Slowly decrease the load resistor to obtain the load current values listed in Table (14) and measure the corresponding generated voltage (UL) and record both in the table.
6. To finish the experiment first switch (OFF) the Universal Power Supply and then the Control Unit.

Table (14)
Load characteristics of synchronous generator

IL/A		0.3	0.4	0.5	0.6	0.7	
UL/V							
Load resistor	R1+R2	R1+R2	R1	R1	R1	R1	R1

Notes:

- Check the setting of the torque attenuator.
- Monitor the exciting current and the speed. Both values must be kept constant during experiment.
- Note that for $I_L < 0.3$ A R1 and R2 must be connected in series on the Universal Resistor as shown in Figure (44). Only R1 is required for $I_L > 0.3$ A; the connections to R2 must be removed. To do this switch the system off and connect R1 only. Set the potentiometer of R1 to the left stop (1 k Ω).
- The start and end value for I_L in Table (14) must be measured.
- Carry out the measurements without delays if possible. If the machine heats up too much, the measuring results deviate and the machine must cool down.

Report & discussion:

1. Draw the load characteristics measurements listed in Table (14).
2. What do you learn from these characteristics?
3. How is the operating principle of the synchronous generator designated in this experiment?

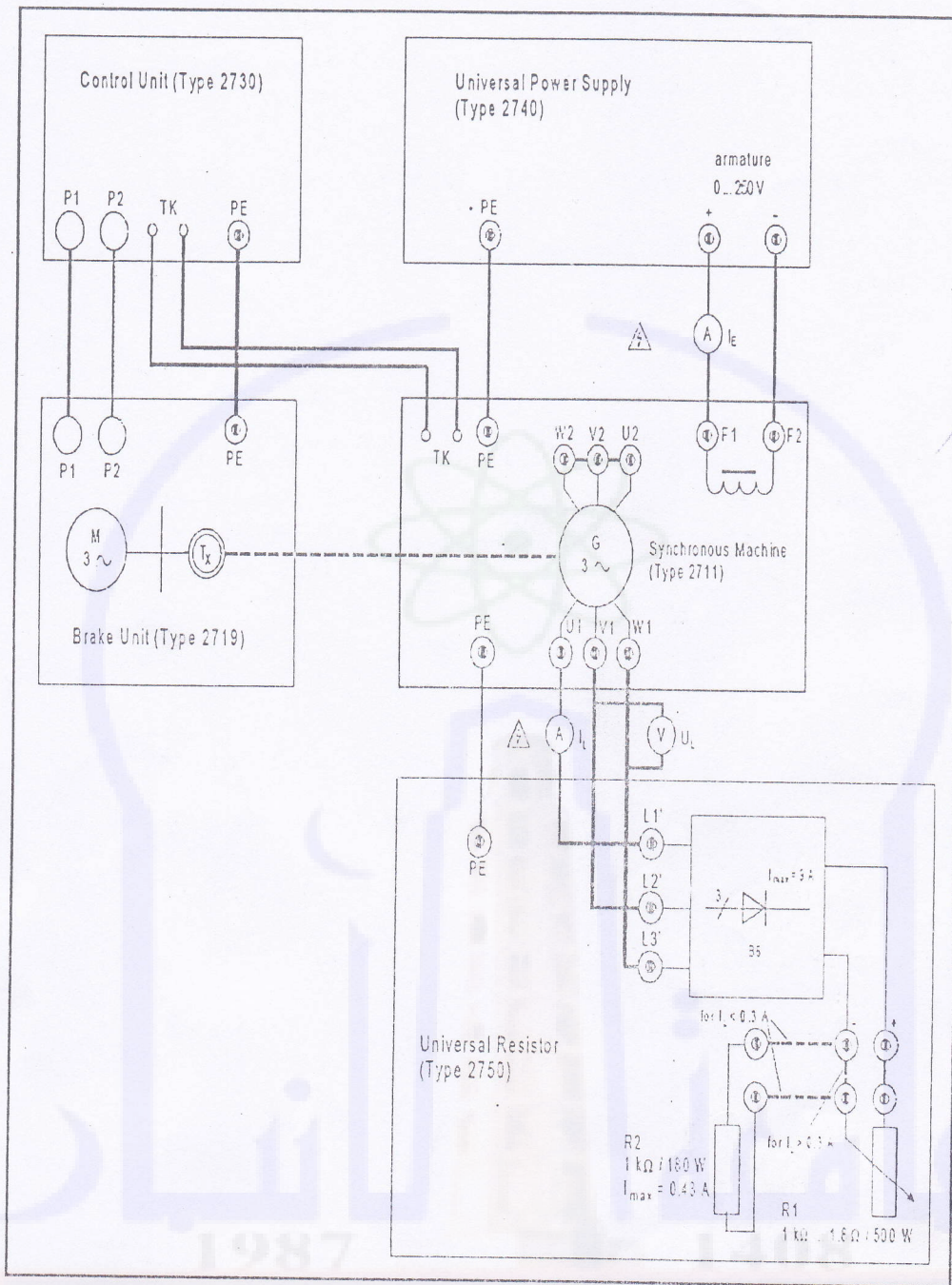


Figure (44)
 Connection circuit diagram of Synchronous Generator
 To obtain the load characteristics