EXPERIMENT 9

VOLTAGE REGULATION OF SYNCHRONOUS GENERATOR

EQUIPMENT

* 3 Phase Synchronous Generator
* Load Box
* AC Voltmeter
* PMDC Motor as a prime mover
* Variable DC Supply

INTRODUCTION

SYNCHRONOUS GENERATOR

The **synchronous generator** or alternator is an electrical **machine** that converts the mechanical power from a prime mover into an AC electrical power at a particular voltage and frequency. The **synchronous** motor always runs at a constant speed called **synchronous** speed.

FUNCTION OF SYNCHRONOUS GENERATOR

A **Synchronous Generator** is an AC **Generator** that converts mechanical energy to AC Electrical Energy. The **synchronous generator** is found at power stations where it is synchronized with the turbine.

VOLTAGE REGULATION

Voltage regulation of an alternator is defined as the “Rise in voltage when full load is removed (field excitation and speed remaining the same) divided by the rated terminal voltage.

% voltage regulation= 𝑬o−𝑽 / V∗ 𝟏00

(𝐸𝑜-V) is the arithmetical difference.

VOLTAGE REGULATION OF SYNCHRONOUS GENERATOR

The **Voltage Regulation** of a **Synchronous Generator** is the rise in **voltage** at the terminals when the load is reduced from full load rated value to zero, speed and field current remaining constant. It depends upon the power factor of the load.



OBJECTIVE

* To get familiarize with voltage regulation of synchronous generator.
* The **principle** of operation of **synchronous generator** is electromagnetic induction. If there exists a relative motion between the flux and conductors, then an emf is induced in the conductors.
* To determine the voltage regulation of an alternator by the synchronous impedance method.

APPLICATION

* **Synchronous generators** are commonly **used** for variable speed wind turbine applications, due to their low rotational **synchronous** speeds that produce the voltage at grid frequency.
* **Synchronous generators** in variable speed operation will generate variable voltage and variable frequency power.
* **Synchronous Generator** is **used** to supply **power** which are mainly large **generation** units like thermal, hydro, **nuclear** and Gas **power plant** etc.
* **Synchronous generators** are used to generate electricity in hydro power plant and thermal power plants with gas or steam turbine.

PROCEDURE

In case of small machines, the regulation may be found by direct loading procedure is as follows:

* Connect the circuit as shown in Figure 9.1.
* The No Load voltage is set to be 110V using field current rheostat.
* The alternator is driven at synchronous speed and the terminal voltage is adjusted to its rated value V.
* The load is varied until the wattmeter and ammeter (connected for purpose) indicate the rated values at defined P.F.
* Then the entire load is thrown off while the speed and field excitation are kept constant. The open circuit or no-load voltage 𝐸𝐸𝑜𝑜 is read. So, voltage regulation can be calculated using formula given above. Note all the values in Table – I.

OBSERVATION



ISSUE

Didn’t face any issue in this experiment.

CONCLUSION

Synchronous generators are often stressed by short circuit faults having external causes. Long-term average statistics point out that synchronous generators are stressed mostly by line-to-ground and line-to-line short circuit faults. In spite of synchronous generators long history of operation, the research works presented hitherto have not put forward fully sufficient comparative studies with regard to sudden short circuits of the machine. This can be due to the fact that short circuit faults occurring during operation cannot offer sufficient information with a view to fault correct assessment, simply because of the various circumstances in which these faults do practically occur.

POST LAB QUESTIONS

* What is meaning of V.R?

The V.R means voltage regulation. Voltage regulation of an alternator is defined as the “Rise in voltage when full load is removed (field excitation and speed remaining the same) divided by the rated terminal voltage.

2. What is significance of V.R.?

A voltage regulator is used to regulate voltage level. When a steady, reliable voltage is needed, then voltage regulator is the preferred device. It generates a fixed output voltage that remains constant for any changes in an input voltage or load conditions. It acts as a buffer for protecting components from damages.

3. What should be the value of V.R. in ideal cases?

The **ideal voltage regulation** is 0%. It **should** be as low as possible for proper operation of the electrical devices.