SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT201 – ELECTRICAL ENGINEERING & INSTRUMENTATION

II YEAR IV SEM

UNIT 3 – INDUCTION MACHINES

TOPIC 5- Voltage regulation of Alternator

Voltage Regulation

- When an alternator is loaded the armature terminal voltage will be less than the emf induced in the armature.
- Due to the effect of armature reaction there will be a drop in induced emf.
- If the load is disconnected (open-circuited) armature current becomes zero, no armature flux and armature reaction effect.
- Therefore the terminal voltage will be equal to induced emf at no-load conditions.

Voltage Regulation

- The changes in terminal voltage on the application of load at a constant driving speed and field excitation.
- It is expressed in per-unit or percentage of variation in armature terminal voltage from no-load to full-load divided by the rated terminal voltage.

$$\%\ Regulation = \frac{E_o - V}{V} \times 100$$

$$Per\ Unit\ Regulation = \frac{E_o - V}{V}$$

Voltage Regulation

- The variation in terminal voltage also depends upon the magnitude and power factor of the load.
- If the load connected is inductive or resistive type. For lagging and unity power factor conditions the effect of armature reaction
- i.e., the effect of armature flux on main flux will be demagnetizing and cross-magnetising effects respectively.

Voltage Regulation

- Thus the terminal voltage drop hence regulation will be always positive.
- In the case of capacitive loads (leading p.f.), the effect of armature reaction will be a magnetizing effect i.e., armature flux add up with main flux.
- This causes to increase in terminal voltage as the load current increases and the regulation becomes negative.

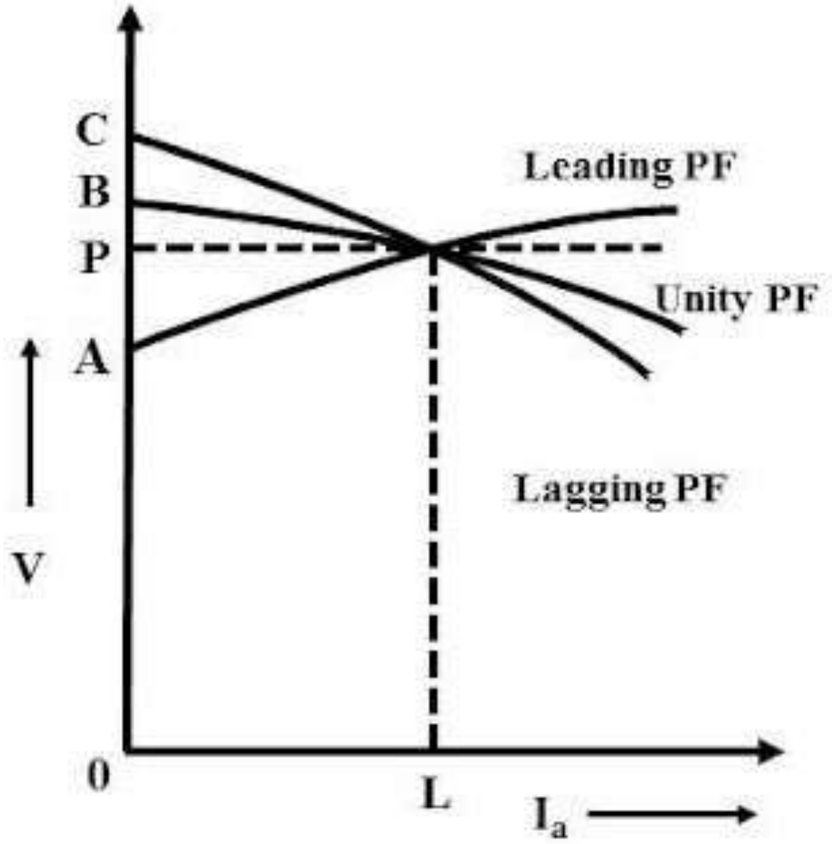
Voltage Regulation

$$Per\ Unit\ Reg. = \frac{Change\ in\ terminal\ voltage\ no-load\ to\ full-load}{Full-load\ terminal\ voltage}$$

$$= \frac{OB - OP}{OP} = \frac{BP}{OP} \quad at\ unity\ p.f.$$

$$= \frac{OA - OP}{OP} = \frac{AP}{OP} \quad at\ lagging\ p.f.$$

$$= \frac{OC - OP}{OP} = \frac{CP}{OP} \quad at\ leading\ p.f.$$



Determination of Regulation

There are several methods of determining the voltage regulation of an alternator.

They are,

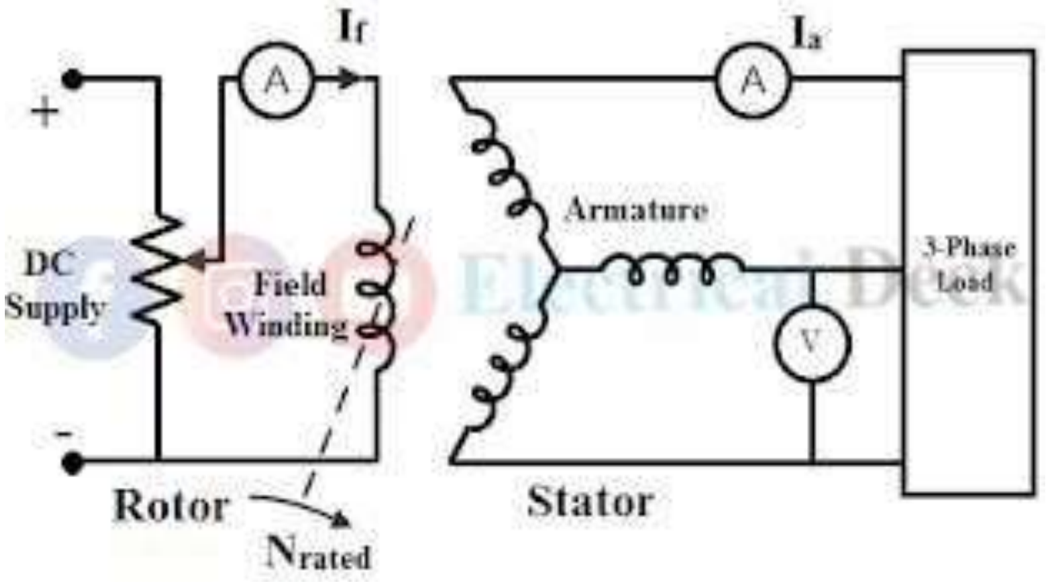
Direct Loading Method.

Indirect Methods.

Determination of Regulation

Direct Loading Method :

The direct loading method is well suited for small rating alternators without actual loading.



Determination of Regulation

Indirect Methods of Voltage Regulation :

- Alternators at the power plants are of large rating as 500MVA.
- It is difficult to determine voltage regulation for such high capacity alternators using direct loading at the laboratory.
- It is therefore to perform indirect methods by indirectly simulating the load conditions which consumes less power.
- The various indirect methods of determining voltage regulation are,

Synchronous Impedance Method or EMF Method.
Ampere-turn Method or MMF Method of Voltage Regulation.
Zero Power Factor Method or Potier Method.
ASA Modification of M.M.F. Method.


Thank You