COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

AC Power Converter

EET 307

Lecture 6

- AC Voltage Controller Circuits -

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Types of Power Electronic Converters

- A power electronic system consists of one or more power electronic converters.
- A power electronic converter is made up of some power semiconductor devices controlled by integrated circuits.
- The switching characteristics of power semiconductor devices permit a power electronic converter to shape the input power of one form to output power of some other form.
- Static power converters perform these functions of power conversion very efficiently.

Types of Power Electronic Converters

1. AC to DC converters (Rectifiers)

- A diode rectifier circuit converts ac input voltage into a fixed dc voltage.
- The input voltage may be single phase or three phase.
- Diode rectifiers find wide use in electric traction, battery charging, electroplating, electrochemical processing, power supplies, welding and uninterruptible power supply (UPS) systems.

Types of Power Electronic Converters

2. DC to DC converters (DC Choppers)

- DC chopper converts fixed dc input voltage to a controllable dc output voltage.
- The chopper circuits require forced, or load, commutation to turn-off the thyristors.
- For lower power circuits, thyristors are replaced by power transistors.
- Choppers find wide applications in dc drives, subway cars, trolley trucks, battery-driven vehicles etc.

Types of Power Electronic Converters

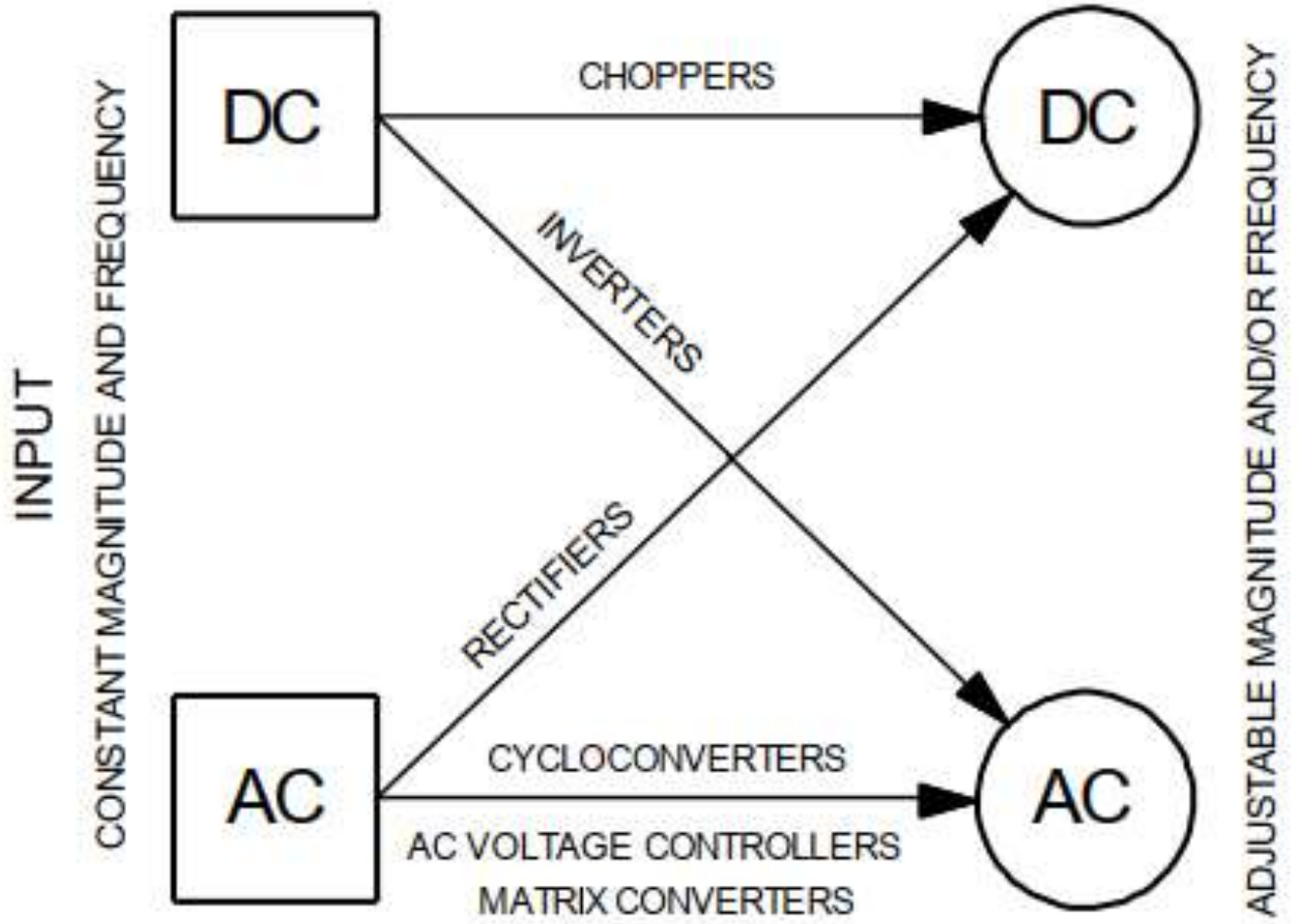
3. DC to AC Converters (Inverters)

- An inverter converts fixed dc voltage to a variable ac voltage.
- The output may be a variable voltage and variable frequency.
- These converters use line, load or forced commutation for turning-off the thyristors.
- Inverters find wide use in induction-motor and synchronous-motor drives, induction heating, UPS, HVDC transmission etc.

4. AC to AC Converters: AC voltage controllers

- These convert fixed ac input voltage into variable ac output voltage.
- These converter" circuits convert fixed ac voltage directly to a variable ac voltage at the same frequency.
- Output voltage is controlled by varying the firing angle delay.
- AC voltage controllers are widely used for lighting control, speed 'control of fans, pumps etc.

Types of Power Electronic Converters



AC Voltage Controllers

- AC voltage controllers (ac line voltage controllers) are employed to vary the RMS value of the alternating voltage applied to a load circuit by introducing Thyristors between the load and a constant voltage ac source.

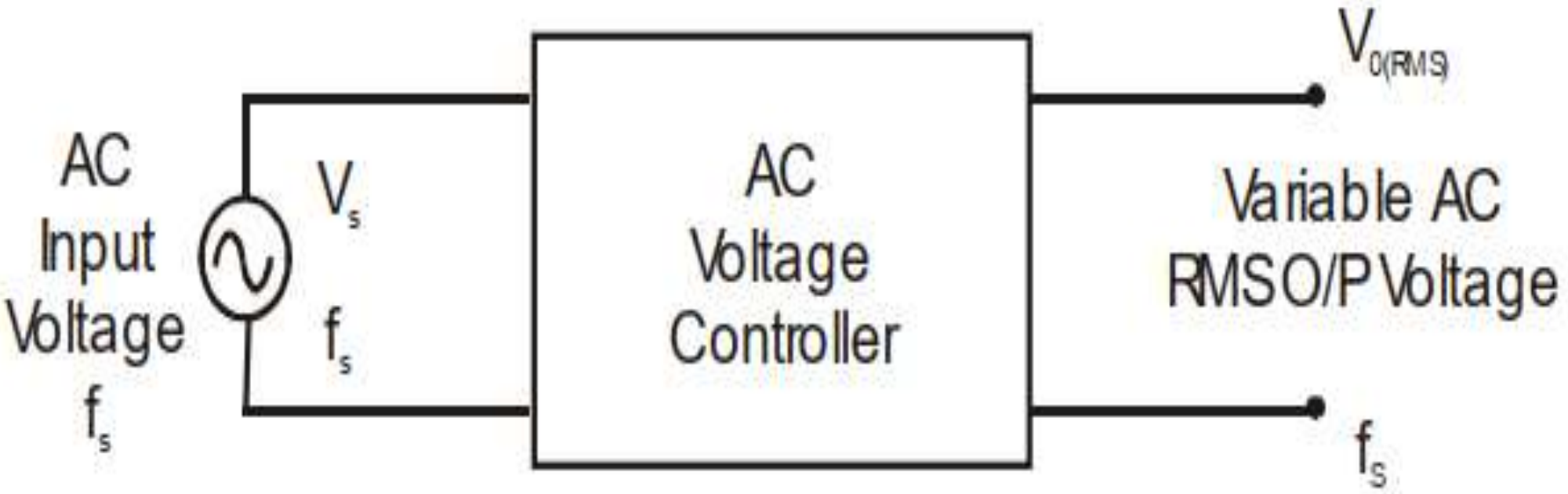
- The RMS value of alternating voltage applied to a load circuit is controlled by controlling the triggering angle of the Thyristors in the ac voltage controller circuits.

AC Voltage Controllers

- In brief, an ac voltage controller is a type of thyristor power converter which is used to convert a fixed voltage, fixed frequency ac input supply to obtain a variable voltage ac output.

- The RMS value of the ac output voltage and the ac power flow to the load is controlled by varying (adjusting) the trigger angle ‘α’

AC Voltage Controllers



Type of AC Voltage Controllers

The AC voltage controllers are classified into two types based on the type of input ac supply applied to the circuit.

- Single Phase AC Controllers.
- Three Phase AC Controllers.

Type of AC Voltage Controllers

- Single phase ac controllers operate with single phase ac supply voltage of 230V RMS at 50Hz supply frequency.
- Three phase ac controllers operate with 3 phase ac supply of 400V RMS at 50Hz supply frequency.
- Each type of controller may be sub divided into
  - Uni-directional or half wave ac controller.
  - Bi-directional or full wave ac controller.

Type of AC Voltage Controllers

In brief different types of ac voltage controllers are

- Single phase half wave ac voltage controller (uni-directional controller).
- Single phase full wave ac voltage controller (bi-directional controller).
- Three phase half wave ac voltage controller (uni-directional controller).
- Three phase full wave ac voltage controller (bi-directional controller).

Applications of AC Voltage Controllers

- Lighting / Illumination control in ac power circuits.
- Induction heating.
- Industrial heating & Domestic heating.
- Transformer tap changing (on load transformer tap changing).
- Speed control of induction motors (single phase and poly phase ac induction motor control).
- AC magnet controls.