Introduction

- Thyristor can be turned on and off within a few microseconds
- operated as fast-acting switches to replace mechanical and electromechanical circuit breakers.
- power transistors - For low-power dc applications
- Advantages:
  - very high switching speeds,
  - no moving parts,
  - no contact bounce upon closing
- Other uses
  - can be designed to provide time-delay, latching, over- and under current, and voltage detections.
SINGLE-PHASE AC SWITCHES

- Two thyristors are connected in inverse parallel.
- Thyristor $T_1$ is fired at $\omega t = 0$.
- Thyristor $T_2$ is fired at $\omega t = \pi$.
- The output voltage is the same as the input voltage.
- The thyristors act like switches and are line commutated.

Other Switches

- A TRIAC may be used instead of two thyristors.
- Two thyristors have a common cathode and the gating signals have a common terminal. (with freewheeling diode)
- A diode bridge rectifier and a thyristor $T_1$ as cross arm.
THREE-PHASE AC SWITCHES

- Three single-phase switches connected to form a three-phase switch
- The load could be connected in either wye or delta.
- Instead of connecting two thyristors, one thyristor and a diode can be used. (i.e. T4 replace with D1)

THREE-PHASE REVERSING SWITCHES

- The reversal of three-phase power supplied to a load can be achieved by extending the three-phase switch with two more single-phase switches.
- Under normal operation, thyristors T7 to T10 are turned off and thyristors T1 through T6 are turned on.
- Line A feeds terminal a, line B feeds terminal b, line C feeds terminal c.
- Under phase-reversing operation, thyristors T2, T3, T5, and T6 are turned off and thyristors T7 to T10 are operative
- Line B feeds terminal c and line C feeds terminal b, resulting in a phase reversal of the voltage applied to the load.
**DC SWITCHES**

- Input voltage is dc and power transistors fast switching thyristors or GTO can be used.
- Turned off by forced commutation.

**SOLID-STATE RELAYS**

- SSRs do not have actual coils and contacts
- They use semiconductor switching devices such as bipolar transistors, MOSFETs, silicon-controlled rectifiers (SCRs), or triacs
- Used in isolating a low-voltage control circuit from a high-power load circuit.
- Can be used to control ac or dc loads
  - For AC load, a triac is used
  - For DC load, power transistor
- The control voltage - can be DC or AC - usually ranges from 3 to 32 V for the dc and 80 to 280 V for the ac.
- Maximum load circuit amps of up to 50 A
Advantages:
- more reliable
- has a longer life because it has no moving parts.
- compatible with transistor and IC circuitry
- does not generate as much electromagnetic interference.
- more resistant to shock and vibration,
- has a much faster response time,
- does not exhibit contact bounce.

Disadvantages:
- Contains semiconductors that are susceptible to damage from voltage and current spikes.
- Unlike the EMR contacts, the SSR switching semiconductor has a significant ON-state resistance and OFF-state leakage current.
Thank You