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Power Electronics Sessional Assignment Total Marks=20

There are different types of Power Electronics Converters used in industries. In this assignment you are required to search the industrial applications and catalogues of these converters and write on any of the following converters, your assignment should cover the following topics;

i) Block Diagram
ii) Circuit Diagram
iii) Waveforms
iv) Equations
v) Specifications
vi) Application in Industries
vii) Converter Design

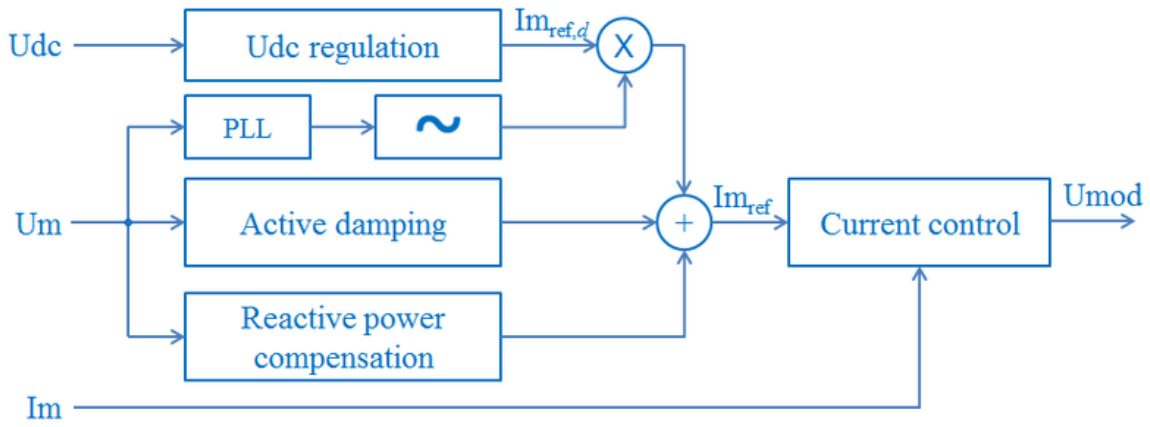
Types of Power Electronic Converters:

a) Controlled Rectifier
b) DC Converter (Buck, Boost and Buck-Boost)
c) AC converters (Cycloconverters, Phase Converter, Triacs, Diacs)
d) Inverters
e) VFDs and VSD

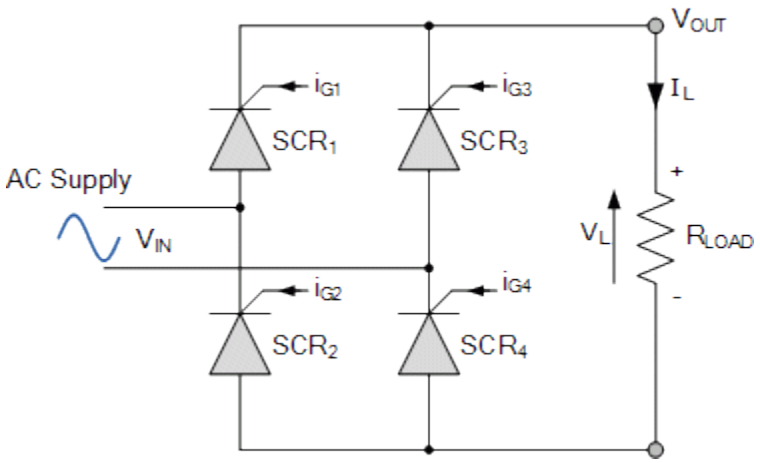
Controlled Rectifier:

Controlled rectifiers are line commutated ac to dc power converters which are used to convert a fixed voltage, fixed frequency ac power supply into variable dc output voltage.
The input supply fed to a is ac supply at a fixed rms voltage and at a fixed frequency. We can obtain variable dc output voltage by using Controlled rectifiers
By employing phase controlled thyristors in the circuits we can obtain variable dc output voltage and variable dc (average) output current by varying the trigger angle (phase angle) at which the thyristors are triggered. We obtain a uni-directional and pulsating load current waveform, which has a specific average value.
The thyristors are forward biased during the positive half cycle of input supply and can be turned ON by applying suitable gate trigger pulses at the thyristor gate leads. The thyristor current and the load current begin to flow once the thyristors are triggered (turned ON) say at $\omega t = \alpha$. The load current flows when the thyristors conduct from $\omega t = \alpha$ to β . The output voltage across the load follows the input supply voltage through the conducting thyristor. At $\omega t = \beta$, when the load current falls to zero, the thyristors turn off due to AC line (natural) commutation.

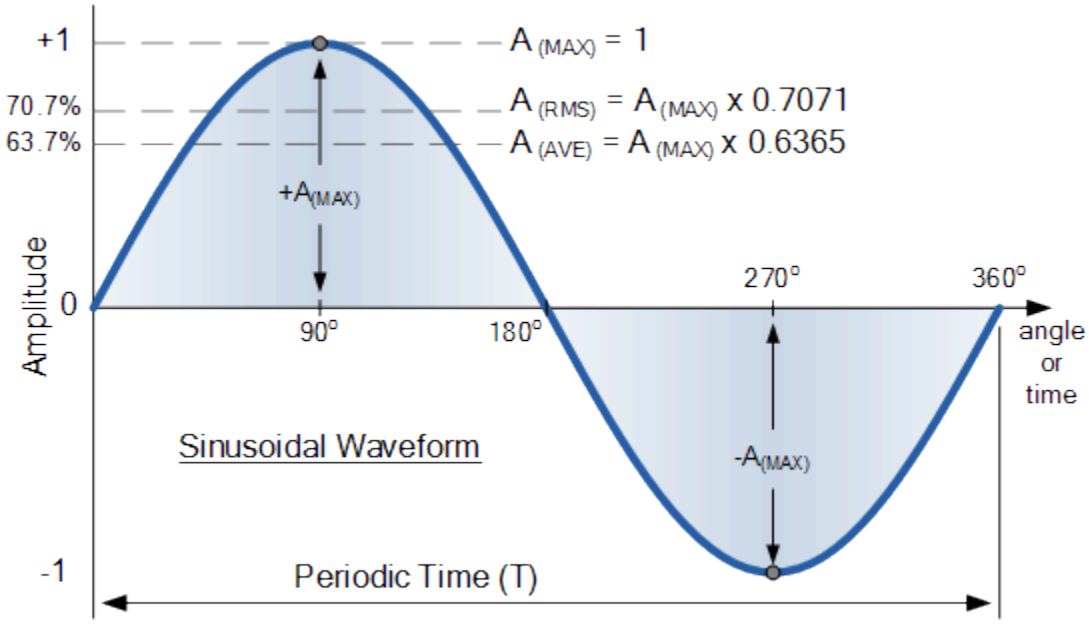
BLOCK DIAGRAM:



CIRCUIT DIAGRAM:



Waveforms:



SPECIFICATION:

Silicon-controlled Rectifier (SCR) Specifications-

There are many different specifications which you'll find on a datsheet for silicon-controlled rectifiers (SCRs).

There is gate trigger voltage, gate trigger current, holding current, on-state voltage, peak gate power dissipation...

What do all of these terms mean? How do they apply to the SCR? Why are they important? What significance do they hold when choosing an SCR for a circuit?

We hope to explain these terms so that you can understand the specifications of an SCR.

EQUATION:

Single Phase Half Wave Controlled Rectifier Circuit:

A Single Phase Half Wave Controlled Rectifier circuit consists of SCR / thyristor, an AC voltage source and load. The load may be purely resistive, Inductive or a combination of resistance and inductance. For simplicity, we will consider a resistive load. A simple circuit diagram of Single Phase Half Wave Controlled Rectifier is shown in figure below.

v_0 = Load output voltage
i_0 = Load current
V_T = Voltage across the thyristor T

APPLICATION:

Controlled rectifiers are used as constant voltage power supplies for float and boost charging of secondary (rechargeable) batteries. Uses include:

- Inverters and UPS systems.
- No-break DC supplies for telecommunications, electrical switch rooms, emergency lighting, etc.
- First stage of switch mode power supplies ("wall warts") for cell phones, laptops and other gadgets.

Converter Design: