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Application of Power Electronics in Transmission of Electrical Energy

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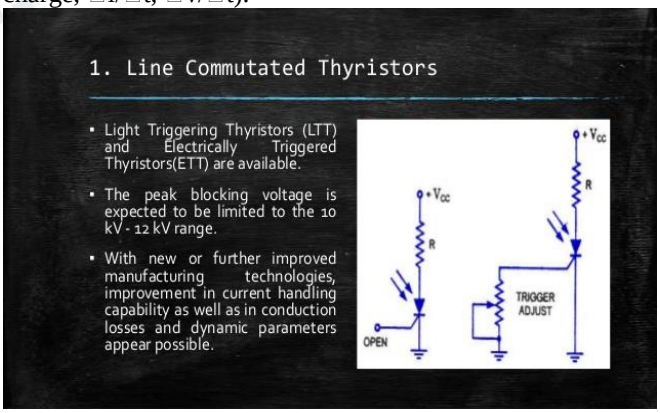
Abstract:- **In our paper, we have compared various Thyristor and its working principal suitable for the various application. Applications of power electronics range in size from a switched mode power supply in an AC adapter, battery chargers, audio amplifiers, fluorescent lamp ballasts, through variable frequency drives and DC motor drives used to operate pumps, fans, and manufacturing machinery, up to gigawatt-scale high voltage direct current power transmission systems used to interconnect electrical grids. Power electronic systems are found in virtually every electronic device.**

I. INTRODUCTION

POWER electronics is a technology for using power devices to convert efficiently electric power into the optimum characteristics. As a key component for improving the energy efficiency and performance of various equipment, power electronics contributes to the realization of both a prosperous and comfortable way of life and a sustainable society by reducing CO2 (carbon dioxide) emissions in areas as diverse as electric power, industry, transportation, and home appliance. Applications of power electronics range in size from a switched mode power supply in anAC adapter, battery chargers, audio amplifiers, fluorescent lamp ballasts, through variable frequency drivesand DC motor drives used to operate pumps, fans, and manufacturing machinery, up to gigawatt-scale high voltage direct currentpower transmission systems used to interconnect electrical grids. Power electronic systems are found in virtually every electronic device.

II. POWER ELECTRONICS DEVICES

In the past decade, there has been a remarkable progress in the high-power semi- conductor devices Newer circuits are now evolving which utilize turn-off devices to achieve self-commutated configurations. In all utility applications the semiconductor devices which are used as switches offer a whole new dimension in controlling the high voltage systems which was not feasible earlier. Not only are these switches much faster, they also do not wear out like the mechanical switches. From the many variations of power electronic devices, it appears that three types will be dominant for FACTS and HVDC applications during the next 5 to 10 years, viz. the line commutated thyristor, the gate turn-off thyristor, and the insulated gate bipolar transistor. Line Commutated Thyristors: LTT and ETT are available. The peak blocking voltage is expected to be limited to the 10 kV - 12 kV range. With new or further improved manufacturing technologies, improvement in current handling capability as well as in conduction losses and dynamic parameters appear possible (e.g. recovery charge, □i/□t, □v/□t).



Gate turn-off thyristor. (GTO): The blocking voltage and current handling capabilities are still increasing: 6kV, 6kA have been announced and higher ratings are expected. Progress in manufacturing technologies should result in reduced switching losses and snubber requirements. However,gate power requirements are not expected to reduce.

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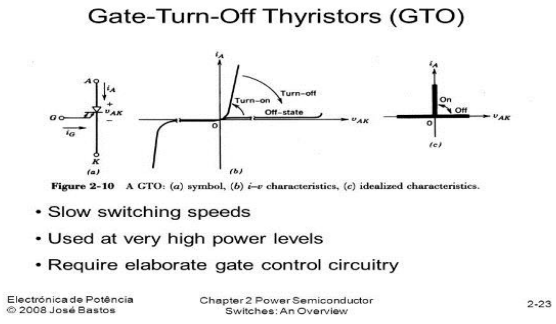
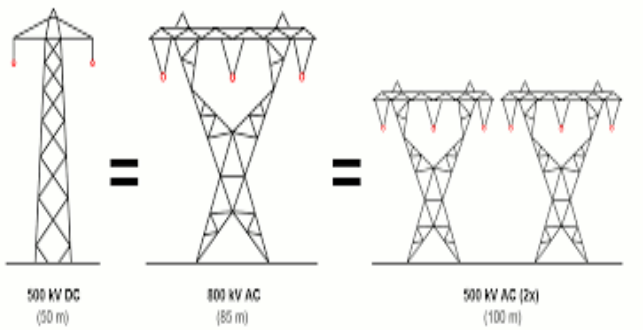
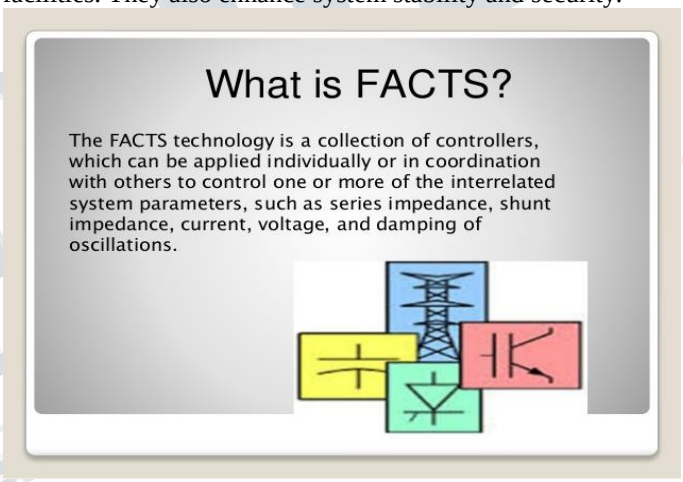




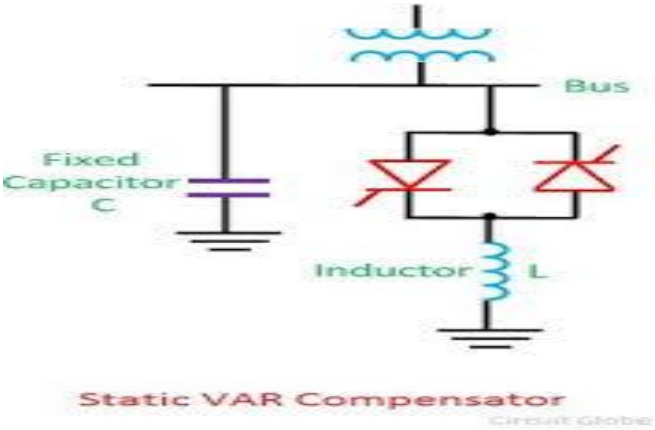
Insulated Gate Bipolar Transistor (IGBT): It appears reasonable to expect that for future modules, blocking voltages will increase above 5kV and current handling capability for modules to at least 2kA. To fully make use of such parameters for FACTS applications, it would be necessary that matching fast switching diodes are also available. Much work seems to be necessary to substantially reduce the high on-state voltage.

Different Power Electronics Systems and Applications are:
1.High Voltage DC:The first application of power electronics in power transmission is the technology of HVDC which started by using mercury ionic valves, then switched to thyristors and has been instrumental in pushing thyristor technology to ever increasing device ratings. Adoption of LTT has made a great contribution to the development of compact and reliable thyristor values. The HVDC system would control bidirectional flow of 2.8 GW on 50.5 KM long submarine transmission cables and 50 km long overhead transmission lines between two electric power companies in Japan thus resulting in a higher degree stability in power systems.

2. Flexible AC: Transmission Systems FACTS controllers can be used to increase the transmission capacity up to the thermal limit of transmission lines, aid in fast voltage control in event of contingencies and avoid loop flows causing undesirable loading of certain transmission facilities. They also enhance system stability and security.



3.Static VAR Compensator:The SVC uses the conventional thyristor to achieve fast control of shunt connected capacitors and reactors. The SVC provides a rapid and fine control of voltage without moving parts and is readily available in current market.



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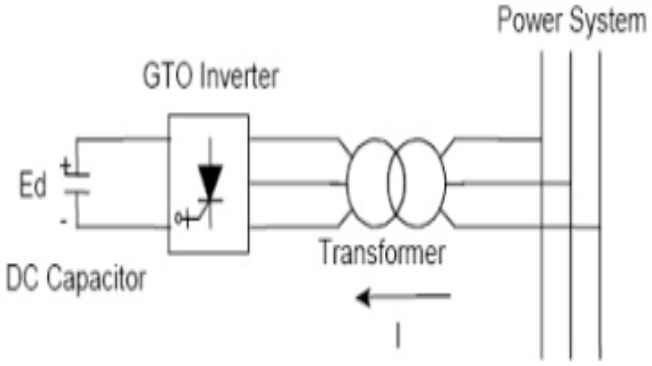
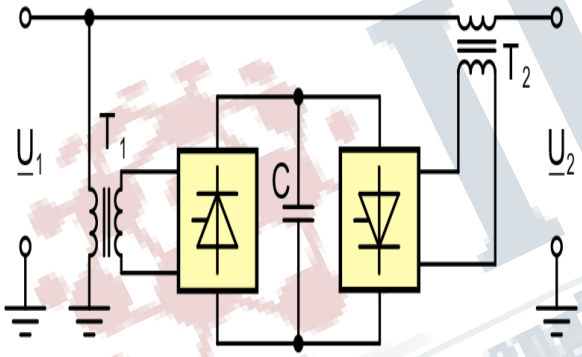
4.Static Synchronous Compensator (STATCOM): The application of a static synchronous generator to regulate reactive power and/or ac voltage magnitude is called STATCOM. The reactive power of a STATCOM can be adjusted continuously from 100% inductive to 100% capacitive by controlling the internal voltage magnitude.



5.Unified Power Flow Controller In case of UPFC, an AC voltage vector generated by a thyristor based inverter is injected in series with the phase voltage. The driving DC voltage for the inverter is obtained by rectifying the AC to DC from the same transmission line.



LIMITATIONS

Although application of power electronics is gaining momentum, the total revolution in power system on this account is still far ahead. Power electronics based technologies will not appeal to the system planners and operators till such time they are absolutely surethat such schemes can perform properly and reliably and the matters like maintenance, training covered. It and quality management are also can be easily appreciated that dependability and reliability are utmost important for electric power industry.

III. CONCLUSION

Power Electronics application to power system is steadily coming up. Over the years, there has been increased understanding of Power Electronic Equipment to cope upwith versatile applications. Devices have been improved to suit the applications expected of them. Further, the unbundling of vertically integrated utilities is also forcing power system planners to adopt these applications wherever viable.

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