REACTIVE POWER CONTROL WITH MINIMIZED EQUIPPED CAPACITOR USING SVC

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Abstract-Reactive power compensator from the point stored energy in the capacitor and proposes a single phase full bridge configuration of semiconductor switches to be used with reduced equipped capacitance for reactive power compensator by applying this concept to shunt type Static VAR Compensator can be achieved with reduced sized capacitor additionally the switching loss can be reduced due to distinctive the double of the line frequency modulation technic and voltage control method based on the reduced capacitance and high voltage ripple in the capacitor are proposed.

I .INTRODUCTION

REACTIVE power compensation is one of the valuable applications for power electronics technology. For ac power transmission and distribution system, various types of static reactive power compensator have been proposed. Shunt compensation is widely used to improve power factor and voltage stability. A static synchronous compensator (STATCOM) based on voltage source converter (VSC) can be said to be the most advanced shunt type reactive power compensator. In contrast with thyristor based reactive power compensators, the STATCOM can directly generates reactive power and has good harmonics characteristics due to the use of full controlled semiconductor switches. A static synchronous series compensator (SSSC) is a VSC connected to the grid in series, usually by a transformer. That can be considered to be a series compensation version of the STATCOM. Usually series compensator is required to inject only small percentage of voltage compared to the system voltage, since the purpose of using series compensation is cancelling existing unwanted series inductance.

Therefore, line frequency switching can be an option since generated harmonic components in total voltage and impact to the current can be within an acceptable amount. A gate commutated series capacitor (GCSC) is another type of series compensator, which is a series connected ac capacitor with a semiconductor shunt switch and is operated with line frequency switching. A magnetic energy recovery switch (MERS) is also proposed as a series compensator, which consists of a single phase VSC and operated with line frequency switching. The capacitance becomes like one of fixed ac capacitors; therefore, it can be said that the GCSC and MERS are basically series capacitor, but have some controllability by semiconductor switches.

II.EXISTING SYSTEM

In this system there are some problems are available .The STATCOM is a shunt reactive power compensatorwhich consists of a voltage source converter and a gridconnectinginductor. Especially in the single phase configuration,quite a large capacitance is needed to achieve an almost constant dc voltage in the capacitor. For three phaseapplications, if unbalance operation is needed, a large capacitance is also needed. Recently, a multilevel topologywhich consists of series connected several single-phase bridgecircuits has been studied to build a medium voltage STATCOMfor power distribution. This is motivated by theneed for eliminating line frequency transformer which is themost space taking component, and this topology can achievethe medium voltage STATCOM.

This capacitor peak voltage, which is equal to the voltage applied to the semi-conductor switches and the capacitor, is higher than the peak of *v* conv. Using the none offset mode can reduce the required capacitance to achieve a given rated reactive lower generation; however, is not attractive from the point of voltage rating utilization. Higher semi-conductor voltage rating is needed; additionally, the capacitordimension cannot be reduced even the capacitancebecomes low due to higher voltage rating needed also for thecapacitor. This paper proposed the basic concept of the control for reduced capacitance; therefore, discussed only steady state operation and step change with limited condition.

Advantages:

- The line frequency switching and small sized capacitor
- However, large harmonic current generated and large grid connected inductor needed are challenges.
- Small required capacitor
- Low harmonics characteristics.
- Improve the power factor.
- Reduced the switching losses

This paper discusses common understanding between the "VSC-based" and the "capacitor-based" reactive power compensators, and proposes a modulation-controlled full bridge reactive power compensator with reduced and optimized capacitance .The proposed compensator has advantages from both types, low harmonics characteristics by the modulation, which comes from the VSC-based compensator, and small required capacitance, which comes from the capacitor-based compensator. Fuzzy logic control method is used to correct the reactive power.
This ensures that the peak voltage, which appears in every half cycle, is maintained even when the current set point is changed, if the voltage decreasedue to the internal loss is ignored. The energy stored in the STATCOM, which is all stored in the capacitor at the current zero-crossing, does not change when the current set point is changed; therefore, the active power control is required to compensate only for the internal loss.

III.PROPOSED SYSTEM

Static Synchronous Series Compensator (SSSC) is one of the important series FACTS devices. SSSC is a solid-state voltage source inverter, injects an almost sinusoidal voltage, of variable magnitude in series with the transmission line. The injected voltage is almost in quadrature with the line current. A small part of the injected voltage, which is in phase with the line current, provides the losses in the inverter. Most of the injected voltage, which is in quadrature with the line current, emulates an inductive or a capacitive reactance in series with the transmission line. This emulated variable reactance, inserted by the injected voltage source, influences the electric power flow through the transmission line.

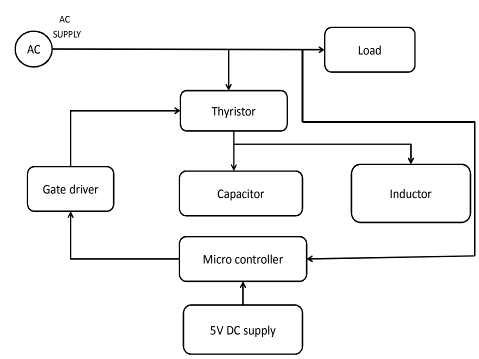


Fig: 1 .Block diagram

The Static VAR Compensator (SVC) is a shunt connected device whose main functionality is to regulate the voltage at a chosen bus by suitable control of its equivalent reactance. A basic topology consists of a series capacitor bank, C, in parallel with a thyristor controlled reactor, L. In practice the SVC can be seen as an adjustable reactance that can perform both inductive and capacitive compensation.

IV. CIRCUIT DIAGRAM

The Static VAR Compensator (SVC) is composed of the capacitor banks/filter banks and air co reactors connected in parallel. The air- core reactors are series connected to thyristors. The current of air-core reactors can be controlled by adjusting the fire angle of thyristors. The SVC can be considered as a dynamic reactive power source. It can supply capacitive reactive power to the grid or consume the spare inductive reactive power from the grid. Normally, the system can receive the reactive power from a capacitor bank, and the spare part can be consumed by an air-core shunt reactor. As mentioned, the current in the air-core reactor is controlled by a thyristor valve. The valve controls the fundamental current by changing the fire angle, ensuring the voltage can be limited to an acceptable range at the injected node(for power system VAR compensation), or the sum of reactive power at the injected node is zero which means the power factor is equal to 1 (for load VAR compensation). Current harmonics are inevitable during the operation of thyristor controlled rectifiers, thus it is essential to have filters in a SVC system to eliminate the harmonics. The filter banks can not only absorb the risk harmonics, but also produce the capacitive reactive power. The SVC uses close loop control system to regulate bus bar voltage, reactive power exchange, power factor and three phase voltage balance.

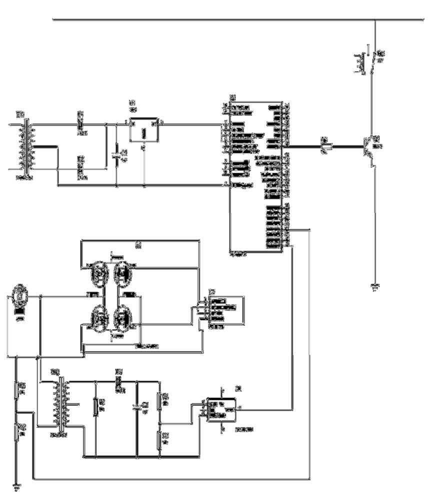


Fig: 2.Circuit Diagram

V.THYRISTOR CONTROL

Thyristors are a class of semiconductor devices characterized by 4-layers of alternating p and n material. Four-layer devices act as either open or closed switches. The 4-layer diode (or Shockley diode) is a type of thyristor that acts something like an ordinary diode but conducts in the forward direction only after a certain anode to cathode voltage called the forward-break over voltage is reached. The basic construction of a 4-layer diode and its schematic symbol are shown The 4-layer diode has two leads, labeled the anode (A) and the cathode (K). The symbol reminds you that it acts like a diode. It does not conduct when it is reverse-biased.

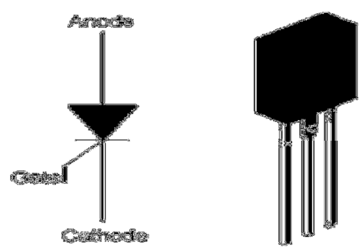
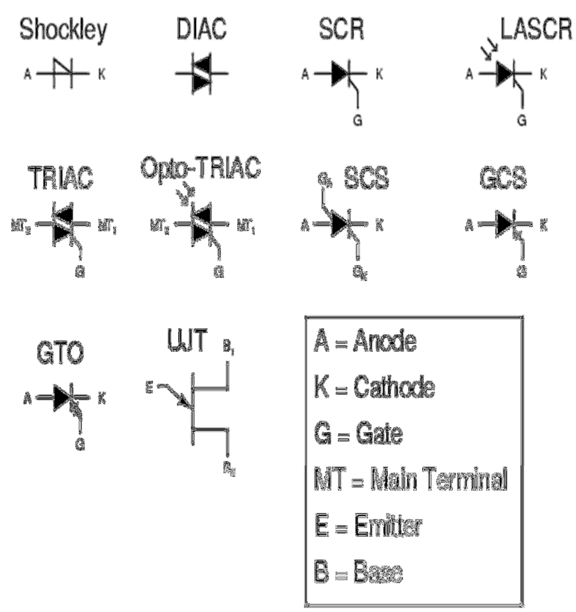


Fig: 7. Thyristor symbol



The unusual connection shown uses positive feedback. The only way to turn on the device is by break over. Once conduction begins, it will continue until anode current is reduced to less than the holding current (I H). This is the only way to stop conduction. Force commutation uses an external circuit to momentarily force current in the opposite direction to forward conduction. The basiccircuit consists of a switch and a capacitor. While the SCR is conducting, the switch is open and Cc is charged to the supply voltage through RC.

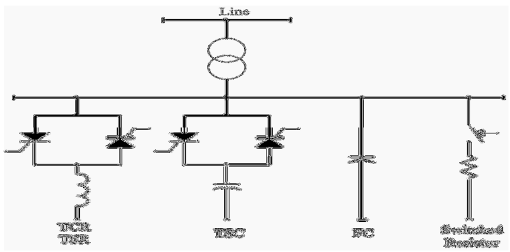


Fig: 8.Equivalent circuit of the thyristor

The figure shows an SCR circuit that permits current to be switched to a load by the momentary closure of switch SW1 and removed from the load by the momentary closure of switch SW2. Closure of SW1 provides a pulse of current into the gate, thus triggering the SCR on. When SW2 is momentarily closed, current is shunted around the SCR, thus reducing its anode current below the holding value.

Thyristors are a class of semiconductor devices characterized by 4-layers of alternating p and n material. Four-layer devices act as either open or closed switches; for this reason, they are most frequently used in control applications.The circuit shown is a relaxation oscillator.When the switch is closed, the capacitor charges through R until its voltage reaches the forward breakover voltage of the 4-layer diode. At this point the diode switches into conduction, and the capacitor rapidly discharges through the diode.

Gate trigger current, IGT. This is the value of gate current necessary to switch the SCR from the forward-blocking region to the forward-conduction region under specified conditions.

VI.CONCLUSION

This paper proposed the minimization of capacitance for static reactive power compensation in single-phase. The capacitancebe reduced to considerably low value theoretically, compared with one to achieve the same reactive power generation by a fixed ac capacitor, but limited by some factors. Oneis the peak voltage appears in the capacitor as discussed in this paper. Additionally, capacitor current must be taken in account. For example, in case of using electrolytic capacitor, the current ripple rating is obviously limiting factor for selecting the capacitor. Therefore, it should be said that the capacitance can be reduced to the value which achieves the capacitor current being equal to its rating, and good utilization of ratings can be achieved. For power transmission and distribution applications, film capacitors are preferred to be used for reliability reasons. In that case, the proposed way can simply reduce the size of the capacitor. Or the proposed way can replace the electrolytic capacitor with film capacitors; in that case, the reliability can be improved without significant size increase. However, more detail considerations about the capacitor including current rating, loss and resulting dimension are needed to make the advantages of the proposed method.

VII. REFERENCES

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