ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 9, Issue 6, June 2022

SVC BASED FLEXIBLE AC TRANSMISSION SYSTEM(FACTS)

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Abstract:

The project designed to enhance the power factor of transmission line with the help of SVC is (static variable compensator).SVC uses of TSC (Tyristor switched capacitors) based on shunt compensation that is controlled from a programmed microcontroller. Initially power factor compensation was achieved using rotating machines like switched capacitor banks or a condenser that usually gets demaged quickly, hence the project uses TSC for compensation is applied to improve the power factor. By connecting an inductive load across transmission line lags the power factor due to lagging load current. Hence to compensate this shunt capacitor is used which draws leading source.

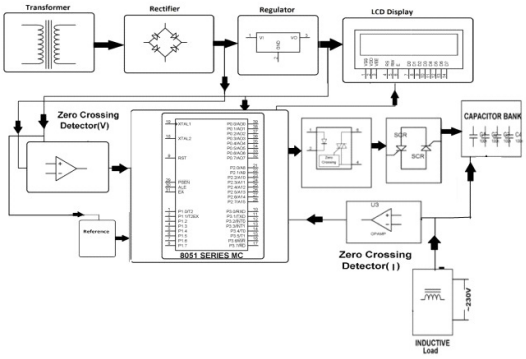
Introduction:

The AC transmission system has various limits classified as static limits and dynamic limits. These inherent power system limits restrict the power transaction, which lead to the underutilization of the existing transmission resources. Traditionally, fixed or mechanically switched shunt and series capacitors, reactors and synchronous generators were being used to solve much of the problem. However, there are restrictions as to the use of these conventional devices. Desired performance was not being able to achieve effectively. Wear and tear in the mechanical components and slow response were the heart of the problems. [2] discussed about E-plane and H-plane patterns which forms the basis of Microwave Engineering principles.

1. Working Principle

In this project SVC uses TSC (Thyristor Switched Capacitors) based on shunt compensation that is controlled from a programmed microcontroller. Initially, power factor compensation was achieved using rotating machines like switched capacitor banks or a condenser that usually gets damaged quickly, hence the project uses TSC for compensation. The mechanism of shunt capacitive compensation is applied to improve the power factor. By connecting an inductive load across transmission line lags the power factor due to lagging load current. Hence to compensate this shunt capacitor is used which draws leading source voltage current thus improves power factor. The project requires an operational amplifier that generates lead time between zero voltage pulse and zero current pulse. This lead time is given to two interrupt pins of microcontroller of 8051 family. SCRs are arranged in series and interfaced with microcontroller that actuates optical isolators in bringing shunt capacitors into load circuit till power factor reaches.

BlockDiagram



Proposed Work

The designed circuit shows the overall effect of the whole system due to use of FACTS devices installed locally. Control Strategies can be developed by designing the pattern and timing of the control input signal of the dynamic FACTS model, as well as where the FACTS device should be located in the transmission system. The Static VAR Compensator (SVC) is a shunt device of the Flexible AC Transmission Systems (FACTS) family using power electronics to control power flow and improve transient stability on power grids The SVC regulates voltage at its terminals by controlling the amount of reactive power injected into or absorbed from the power system. When system voltage is low, the SVC generates reactive power (SVC capacitive). When system voltage is high, it absorbs reactive power (SVC inductive) The variation of reactive power is performed by switching three-phase capacitor banks and inductor banks connected on the secondary side of a coupling transformer. [5] discussed about a project, in this project an automatic meter reading system is designed using GSM Technology. The embedded micro controller is interfaced with the GSM Module. This setup is fitted in home. The energy meter is attached to the micro controller. This controller reads the data from the meter output and transfers that data to GSM Module through the serial port.

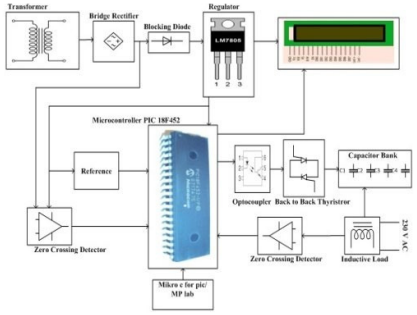


Fig No. 1 Proposed Circuit Diagram

Advantages:

1.The advantages of a capacitor bank in delta connection include the following.

2.When the capacitor generates Kilovolt-Ampere Reactive (KVAR) then that is proportional to the square of the voltage applied.

3.So, if the voltage is higher, the KVAR is also more. So the capacitor in this connection will provide high KVAR compared to the bank connected in star connection because, in star type connection, the applied voltage is low compared to delta connection.

Applications:

1. Capacitor banks are mainly used to enhance the electrical supply quality & also to enhance the power systems efficiency.
2. This is most frequently used for the correction of AC power supply in industries where electric motors and transformers are used.
3. As this bank uses an inductive load, then they are vulnerable to power factor lags & phase shifts within the power supply, so it results in a system efficiency loss.
4. When these are used in the system then the power lag can be solved at less cost for the organization by making some changes in the power grid
5. These are used in radars, pulsed lasers, Marx generators, detonators, coilguns, fusion research, nuclear weapons, electromagnetic railguns, etc.
6. Generally, capacitor banks decrease the phase difference among the current & voltage.
7. The power factor (pf) can be maintained close to unity.

Component List :

1. Step down transformer
2. Voltage regulator
3. Capacitors
4. Diodes

OPERATION OF REGULATED POWER SUPPLY:

Step Down Transformer

A step down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit. .[4] presented a book, We know, correspondence implies exchange of data from source to beneficiary. In conventional communication, when source and beneficiary were situated in long separation, this exchange used to occur by interfacing source and beneficiary physically through leading wires, which would convey data as electrical signs. Any exchange of data between focuses that don't have a physical association, similar to wire or link association, would be WIRELESS COMMUNICATION.

Rectification

Rectifier is an electronic circuit consisting of diodes which carries out the rectification process. Rectification is the process of converting an alternating voltage or current into corresponding direct (dc) quantity. The input to a rectifier is ac whereas its output is unidirectional pulsating dc. Usually a full wave rectifier or a bridge rectifier is used to rectify both the half cycles of the ac supply (full wave rectification). Figure below shows a full wave bridge rectifier.

Transformer

A transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (emf) or voltage in the secondary winding.

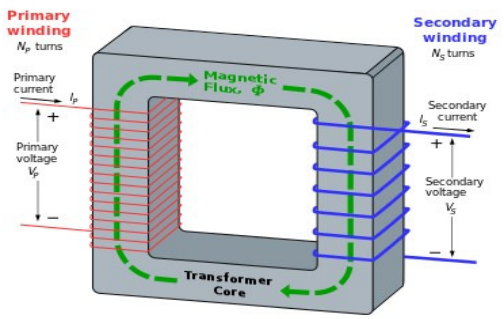


Fig No.2 Transformer

2. Conclusion:

With the history of more than three decades and widespread research and development, FACTS controllers are now considered a proven and mature technology. The operational flexibility and controllability that FACTS has to offer will be one of the most important tools for the system operator in the changing utility environment. In view of the various power system limits, FACTS provides the most reliable and efficient solution. The high initial cost has been the barrier to its deployment, which highlight the need to device proper tools and methods for quantifying the benefits that can be derived from use of FACTS.

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