TO REDUCE FERRANTI EFFECT BY USING THYRISTOR SWITCHED REACTOR

[1]Pund Abhishek,[2]Ghongade Shankar,[3]Talankar Vaibhav,[4]Prof.Patil Manjusha
[1] U.G. Student, [2] U.G. Student, [3]U.G. Student, [4]Assistant Professor
[1]Department of Electrical Engineering,
[1]JSPM's, BSIOTR, Wagholi, Pune, India

Abstract: This paper is basically explains the reactive power compensation technique in power system. Due to Ferranti effect, the receiving end voltage is greater than the sending end voltage. This effect is due to charging current of the line. Due to this voltage amplification takes place. This effect occurs only in Medium & Long transmission line. To compensate this, shunt inductors (TSR) are automatically connected in the transmission line.

Index Terms **– FACTS, Ferranti effect, TSR, Reactive power compensation, TRIAC**

I. Introduction

Voltage regulation is very important parameter in transmission system. Voltage regulation is very essential in transformer.If voltage regulation is poor in transmission line, then the transmission line losses are increased. The equipments connected in transmission system causes malfunction. Due to this we need to adopt the voltage regulation improvement technique.

Due to Ferranti effect, the receiving end voltage is greater than the sending end voltage. This effect is due to charging current of the line. Due to this voltage amplification takes place. This effect occurs only in Medium & Long transmission line.

In previous years, we used the conventional method for improvement in voltage regulation. We used the mechanical switches for switching the compensation equipments. Due to this switching losses occurred are more. So to overcome this problem, we use the power electronic devices for switching.

The power electronic switches used are known as FACTS (flexible alternating current transmission system). FACTS is a system composed of static equipment used for the AC transmission of electrical energy. It is used for controllability and increase power transfer capability of the power system.

II. REACTIVE POWER COMPENSATION TECHNIQUES

Reactive power compensation is an essential subject in power electronic systems. In recent years, to increase the capacity and controllability of transferred power and to satisfy the reactive power demand of the system efficiently the power electronics components and static controllers are used in compensation. The FACTS (Flexible AC Transmission Systems) devices are used for compensation such as semi-conductor-based switching type inverters and shunt reactive compensators. FACTS (flexible ac transmission systems) controllers, are faster than common mechanical controllers, which are based on high speed power electronics devices. In these systems, to overcome compensation problems static var compensators (SVCs) are used with fast response time characteristics. to produce or absorb reactive power in the compensation of transmission lines the FACTS devices do not need capacitor or reactor groups. Many applications have been developed to boost the stability of power systems with the development of FACTS devices in power transmission systems and utilization. FACTS devices can be used to control power flow and to increase the stability of the system. The main advantages of these devices are their controllability and flexibility. They are mainly implemented to increase the voltage stability, voltage control of power systems and to enhance the stability of power systems. These applications can be done with controlling the voltage level and phase angle.

The compensation technique available are:-

- Series Compensation
    1. Thyristor controlled series capacitor (TCSC)
    2. Thyristor controlled series reactor (TCSR)
    3. Thyristor switched series capacitor (TSSC)
    4. Thyristor switched series reactor (TSSR)

- Shunt Compensation
    1. Thyristor controlled reactor (TCR)
    2. Thyristor switched capacitor (TSC)
    3. Thyristor switched reactor (TSR)

TSR

To overcome the power quality problem of distribution system, we have number of power quality solution techniques by using FACTS controllers, which use newly available power electronics devices. TSR is one of them. Shunt capacitance in the transmission line cause Ferranti Effect.

Due to Ferranti effect, the receiving end voltage is greater than the sending end voltage. Shunt inductors are automatically connected in the transmission line. Shunt inductors are varied in stepwise manner by fully or zero conduction.

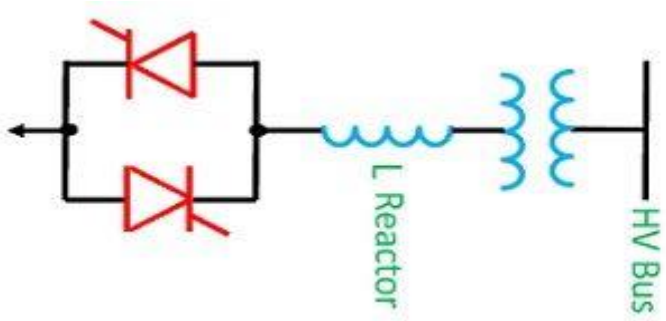

Fig.1 Thyristor Switched Reactor

III. LITERATURE SURVEY

This project is basically designed to implement FACTs in power system. We know that when there is low load or charging of transmission line the receiving end voltage is greater than sending end due to effect of capacitance form in medium and long transmission line. Various types of insecurities and venerable types of faults and other insecurities are present in power system due to which power system equipment like transformer, bus bar, generator, etc. get affected so we need fast and reliable method to control. All thing is control by FACTs technology effectively and in less time. This projects give you as much information on the cure of increased voltage in receiving end side due to capacitance effect called as Ferranti effect with the help of FACTs technology.

IV. PROPOSED SYSTEM

In this model we used two no. of capacitor each of 2.5µF rating connected in parallel so total capacitance is 5µF act as natural capacitance formed in transmission line power system. In this proposed model we use choke, TRIAC, potential transformer, microcontroller (Arduino) , relay, LCD, capacitors and resistor of different ratings, crystal oscillator, etc. these all components makes a facts model. The aim of this model is to reduce the voltage amplification when the switches is turned on. As in normal mode, the capacitance effect is there so receiving end voltage is higher than sending voltage. So when the compensation mode is on so voltage is being compensation is done.

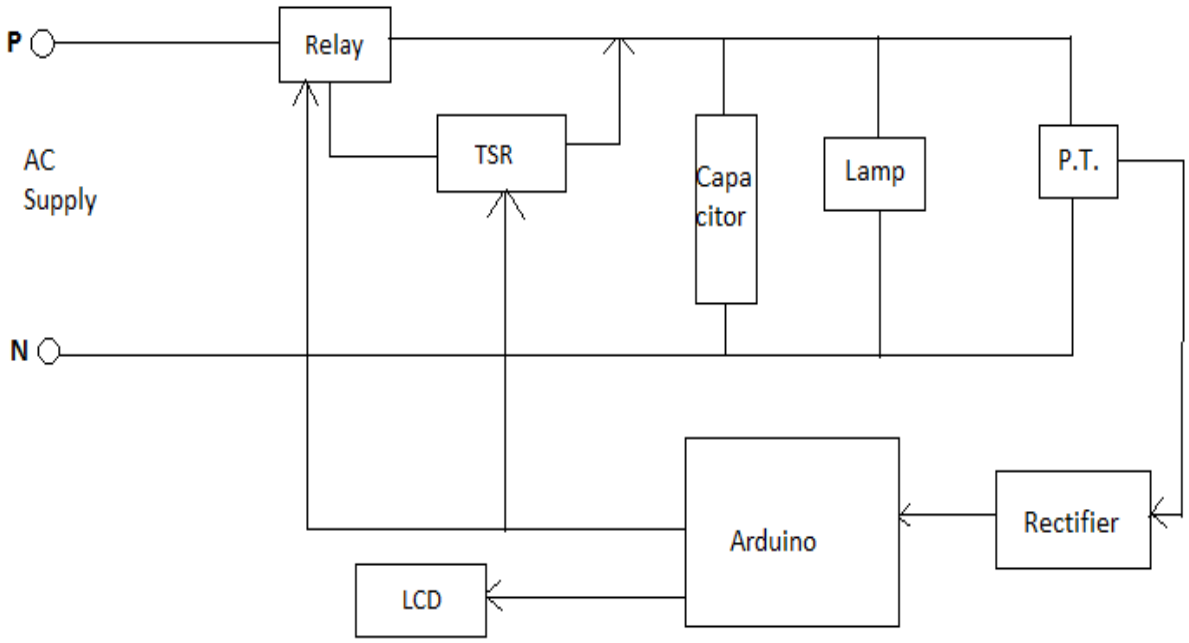

Fig.2 Block Diagram

COMPONENTS

1. Arduino

Arduino Uno is a microcontroller. It has 14 digital input/output (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection , a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

2. Choke

A choke coil is an inductor which blocks AC & allows DC. A choke is a coil wounded on the core & it has high inductance & low resistance.

3. Capacitor

A capacitor is a electrical charge storage component. It stores the charge in the dielectric medium placed between the two conducting plates. In overhead line two conductors acts as conducting plates & air acts as a dielectric medium.

4. TRIAC

A TRIAC is a semiconductor device which has three terminals to control the flow of current, thus the name Triac. Unlike SCR, TRIAC is bi-directional while SCR is bi-directional.

5. Relay

A relay is a switch. It is electrically operated switch. Relay is used for the swiching purpose in power system.

6. Opto-Coupler

An Opto-Coupler is a semiconductor device that uses a short optical transmission path to transfer an electrical signal between circuits or elements of a circuit, while keeping them electrically isolated from each other.

V. WORKING

Our system would be targeted towards Ferranti Effect detection and compensation in single phase and also 3phase system with minor modifications. For this we plan to use Arduino microcontroller platform based system. The reason is ease of using and programming Arduino platform.

The supply is given to the load through capacitors. Voltage at the load is measured by PT and voltage is stepped down to low power level suitable for Arduino processing using PT. Then the voltage is converted into dc and it is given to the arduino. The voltage at the load is displayed on LCD. If the voltage at the load is beyond the supply voltage then

the arduino switches the relay and TRIAc to bring the inductor in parallel with the capacitor and then the voltage become normal voltage.

VI. RESULTS

1. Reduces Power Losses and Improving Voltage Profile.
2. Improvement in Power Factor.
3. Reduces Reactive Power Flow.
4. Ensure Optimum Power Flow.
5. Improvement in Voltage Regulation.

Table No.6.1 Result Table

System Voltage (volts)	Increased voltage due to capacitor (volts)	Compensated Voltage due to inductor (volts)
200	236	215
210	246	225

VII. CONCLUSION

The Project Basically explains about "Compensation of Reactive Power" using the pure inductance with the help of "Thyristor Switched Reactor". It also explains how to overcome the "Ferranti Effect" whenever there is charging of transmission line. The introduction of inductive reactance in transmission lines is done through switched thyristors (TSR). Whenever there is a dominating capacitive load, with the help of inductance we can compensate the overall power. We studied and observed the characteristics and behavior of individual components which are used for our project.

REFERENCES

[1] Madhur Srivastava, Ankit Kumar, Nripendra Vikram Singh, Y.B. Mandake 2018 "Reactive Power Compensation By Thyristor Switched Reactor (TSR) In SVC FACTS" IJSART| ISSN [ONLINE]: 2395-1052

[2] Anupriya, Monika Saharan, Nishant Jakhar, Navneet Roy Chowdhury 2017 "Ferrenti Effect Compensation by Thyristor Switched Reactor (TSR) in FACTS" International Journal for Research in Technological Studies| ISSN (online): 2348-1439

[3] Rishabh Jain, Sunil Kumar Sahu, Venkata Srikar, Rohit, Suvit Chitnis, Mr.Mousam Sharma "FACTS (Flexible AC transmission system) by using TSR (Thyristor Switch Reactance)" 2017 International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering | ISSN (Print) : 2320 – 3765 | ISSN (Online): 2278 – 8875

[4] Gagari Deb 2012 "Ferranti Effect in Transmission Line" International Journal of Electrical and Computer Engineering (IJECE) | ISSN: 2088-8708

[5] R. T. Kalapad 2015 "Review on FACTS devices integrated with TSR" International Journal of Engineering Research and Applications (IJERA) | ISSN: 2248-9622

[6] Nishant Selote, Shruti Hatwar, Pragati Bansinge, Kiran Khobragade, Sachi Ukey 2019 **"**Reactive Power Management By Using TCR And TSC" www.jetir.org | (ISSN-2349-5162)

[7] Chetan E. Morkhade, Bhushan S. Rakhonde 2013 "Improvement in Voltage Profile using FACT Device" International Journal of Scientific & Engineering Research | ISSN 2229-5518

[8] A. Divya Swarna Sri, K. Tejaswini Devi, K. Dhana Raju, B. Tanya 2018 "Depiction and Compensation of Ferranti Effect in Transmission Line" International Journal for Research in Applied Science & Engineering Technology (IJRASET) | ISSN: 2321-9653

[9] Sarvesh A. Gadre, Praveen S. Iyer 2015 " Reactive Power Compensation by using FACTS Devices under NonSinusoidal Condition by using MATLAB Simulation" IJSRD - International Journal for Scientific Research & Development | ISSN (online): 2321-0613

[10] Miss. Reshma Tarannum, Mr. Rashmi Singh 2017"Reducing Ferranti Effect in Transmission Line using Dynamic Voltage Restorer" International Conference on Science and Engineering for Sustainable Development (ICSESD-2017) International Journal of Advanced Engineering, Management and Science (IJAEMS) | ISSN: 2454-1311