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Flexible AC Transmission Using TSR

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Abstract:- The project uses Thyristor Switch Reactance, or TSR, to achieve FACTS. When charging the transmission line, it is done when there is very little or no load at the receiving end. Due to the low load, the transmission line has minimal current flow, which highlights the shunt capacitance. The voltage at the receiving end increases two times more than the voltage at the sending end as a result of this voltage amplification, or Ferranti Effect. Shunt inductors are consequently automatically linked across the transmission line as a compensatory measure.

I. INTRODUCTION

A key element of Flexible AC Transmission Systems (FACTS) that improves power transmission efficiency, controllability, and stability is the Thyristor-Controlled Series Reactor (TSR). It controls transmission line voltage by adjusting line impedance. TSR is made up of impedance control switching devices based on thyristors and a series reactor. Operators can now modify the voltage, power flow, and stability of the system. Reactive power delivery is adjusted by TSR using phase-controlled thyristors in response to system conditions. It modifies firing delay angle to alter current, which reduces voltage rises on weakly loaded lines..

II. METHODOLOGY

A. Hardware Implementation

This process includes designing the prototype, installing the hardware, and choosing the materials and components. Many electronic components will be used in this project. Transformer, Microcontroller At89S52, Thyristor, LCD, Inductive Load, etc. are the principal parts utilized.

➢ *Transformer*

An electric device called a transformer uses inductive coupling between its windings to transmit energy.

The output of the transformer is 12V, 12V, and 0V. This transformer serves as a transformer step-down. The silicon steel with high permeability is used to make the transformer core.

➢ *Microcontroller AT89S52*

With 8K bytes of internal programmable Flash memory, the AT89S52 is a CMOS 8-bit microcontroller that combines great performance and low power consumption. The product is compatible with the industry-standard 80C51 instruction set and pin out and is made with Atmel's high-density nonvolatile memory technology. Program memory can be reprogrammed in-system or using a traditional nonvolatile memory programmer thanks to the on-chip Flash. For many embedded control applications, the Atmel AT89S52 is a highly flexible and affordable microcontroller that combines a configurable 8-bit CPU with in-system programmable Flash on a monolithic chip.

➢ *Thyristor [TSR]*

A four-layer solid state device that regulates current is called a silicon-controlled rectifier, also known as a semiconductor-controlled rectifier. A particular kind of thyristor is referred to by the trade term "silicon controlled rectifier" (SCR) by General Electric. Gordon Hall oversaw a group of power engineers who created the SCR, which Frank W. "Bill" Gutzwiller brought to market in 1957.

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➢ *Liquid Crystal Display {LCD}*

Three control lines and four or eight I/O lines for the data bus are required per the 44780 standard. The LCD can be configured to work with either an 8-bit or a 4-bit data bus by the user. The LCD will require a total of 7 data lines (3 control lines + the 4 lines for the data bus) if a 4-bit data bus is employed. The LCD will require a total of 11 data lines (3 control lines + the 8 lines for the data bus) if an 8-bit data bus is employed.

➢ *Inductive Load*

A primarily inductive load, meaning that the load's alternating voltage is higher than its alternating current. sometimes called load lagging. Inductive loads can be defined as any devices that are manufactured with wire coils. For instance, contactor coils, solenoids, and motors. Toasters, stovetop elements, baseboard heaters, and filament light bulbs are a few examples of resistive loads.

B. Hardware Testing

A continuity test in electronics uses a little voltage to determine whether an electric circuit is complete. To find open routes brought on by poor soldering, malfunctioning components, or mistakes in the circuit diagram, this test is essential after soldering. Multimeters and specialty testers are among the devices utilized; the latter frequently use a simple light or buzzer to demonstrate continuity. This test is especially helpful for finding flaws in circuit connections or locating wire ends in bundles.

C. Power on Test:

This test is run to determine whether or not the voltage at various terminals complies with the specifications. We select the voltage mode on a multimeter. Keep in mind that there is no microcontroller used in this test. First, we examine the transformer's output to see if the necessary 12 volt AC voltage is obtained.

Next, we apply this voltage to the circuit of the power supply. Please take note that we are not using a microcontroller for this test because any excessive voltage could damage the controller.

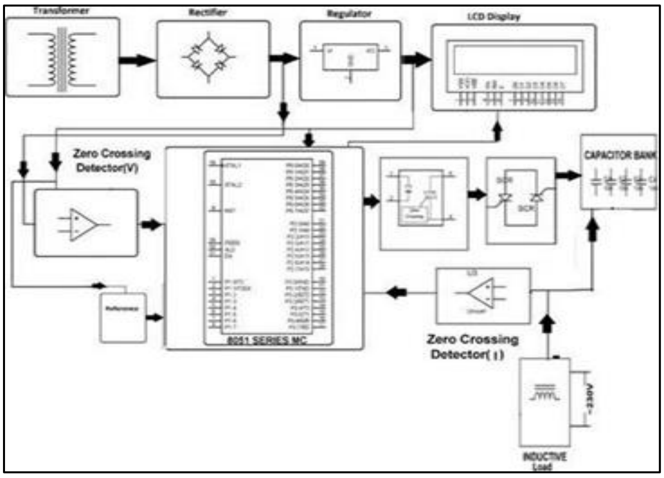

Fig 1 Block Diagram

D. Applications

- Grid integration of renewable power.
- Implementation of HVDC converter terminal performance.
- Load compensation.
- Alleviation of voltage instability.
- Limit short circuit current.
- Mitigation of sub synchronous resonance.
- Improvement of system transient stability limit.

III. SOFTWARE REQUIREMENTS

➢ *Keil Micro Vision (IDE)*

For the ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251, and 8051 MCU families, Keil, an ARM company, produces C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators.

The Keil development tools for the 8051 Microcontroller Architecture cater to all skill levels of software developers, ranging from novices learning about embedded software development to seasoned applications engineers. Just choose the microcontroller.

You want to use from the Device Database to begin a new project, and the µVision IDE will take care of setting up the compiler, assembler, linker, and memory.

IV. CONCLUSION

To sum up, the application and evaluation of Thyristor-Switched Reactors (TSRs) in Flexible AC Transmission Systems (FACTS) offer noteworthy innovations and possible advantages in contemporary power systems. We have investigated the functionality, control approaches, and performance assessment of TSR-based FACTS devices during this study. Our study has shown that TSRs are a useful tool for improving power systems' stability and controllability. TSRs provide accurate and quick reactive power compensation, voltage regulation, and oscillation damping by dynamically altering reactor impedance, which enhances the overall performance and dependability of the system.

Moreover, our analysis has emphasized how crucial thorough modeling and simulation methods are to assessing how TSR-based FACTS devices affect power system dynamics. We have seen firsthand how TSRs reduce power losses, lessen voltage swings, and improve system resilience to disturbances through simulated experiments.

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