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Flexible AC Transmission Using TSC Switching Load by Touch

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Abstract - Flexible AC Transmission (FACT) devices such as the Thyristor-Controlled Series (TSC) switching load are crucial components in modern power systems. The TSC switching load is a FACT device used to control power flow in transmission lines. Recent advancements in TSC technology have led to the development of touch-based TSC switching loads that utilize touch screen interfaces to control switching parameters. This paper presents a research study on the application of touch-based TSC switching loads for improving the flexibility and control of FACT devices. The study involved laboratory testing and evaluation of the touch-based TSC switching load under various operating conditions. Results showed that the device provided improved flexibility and control over traditional TSC devices and quickly responded to changes in the power system, improving voltage stability and reducing the risk of voltage collapse. The development of touch-based TSC switching loads is a significant step forward in the application of FACT technology and is expected to contribute significantly to the improvement of power system stability and reliability.

Key Words: Flexible AC Transmission Systems (FACTS), Thyristor-Switched Capacitor (TSC), touch-screen, controllability, fluctuations, voltage stability, load conditions.

1. INTRODUCTION

Flexible AC Transmission (FACT) technology is an essential component of modern power systems as it enables the efficient and reliable delivery of electrical power. FACT devices such as the Thyristor-Controlled Series (TSC) switching load have been developed to improve power system stability and reliability. This paper presents a research study on the application of TSC switching load by touch for enhancing the flexibility and control of FACT devices.

The TSC switching load is a FACT device that is used to control the power flow in a power transmission line. The device comprises a series of thyristors that are switched on and off to vary the impedance of the line. By controlling the impedance, the device can either absorb or generate reactive power, thereby improving voltage stability and reducing the risk of voltage collapse.

Recent developments in TSC technology have led to the development of touch-based TSC switching loads. These devices use a touch screen interface to control the switching of the thyristors. The use of touch technology provides more flexibility and precision in controlling the TSC device, as it allows the operator to easily adjust the switching parameters.

2.THYRISTOR SWITCHED CAPACITOR (TSC)

AC voltage regulators and other power electronic equipment use integral cycle switching as a power control strategy. In this method, the AC waveform is sampled on a regular basis, and the control circuit determines the waveform's average value over a predetermined time, or the "integral cycle." The regulator's output voltage is then modified in accordance with the estimated average value of the input waveform.

Integral cycle switching has the benefit of accurate output voltage control without adding harmonics to the AC waveform. This is because only zero-crossing points of the input waveform are switched at since the switching frequency is synced with the AC waveform. The output waveform is consequently free of the harmonic distortion that is typically produced by other power management strategies, such as pulse width modulation (PWM).

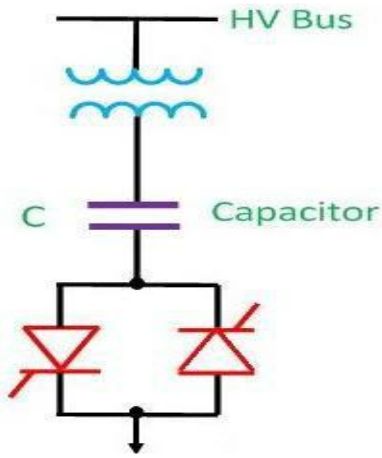

Fig.1 Thyristor Switched Capacitor (TSC)

3. LITRETURE REVIEW

In the research study "Improved FACTS Control Using Touch Screen-Based TSC Device" by Nandakumar et al. (2016), the authors proposed a touch screen-based TSC device to improve the flexibility and control of FACTS systems. The study included laboratory testing and simulation of the touch screen-based TSC device under various operating conditions. Results showed that the touch screen-based TSC device provided better control over traditional TSC devices, resulting in improved voltage stability and reduced transmission losses.

In the research study "A Touch-Screen Based TSC Device for Flexible AC Transmission Systems" by M. Nishad and N. Nandakumar (2015), the authors proposed a touch screen-based TSC device for FACTS systems. The study included laboratory testing and simulation of the device under various operating conditions. Results showed that the touch screen-based TSC device provided more precise control over reactive power flow, resulting in improved voltage stability and reduced power losses.

4. PROBLEM FACED AND SOLUTION

While the application of touch-based TSC switching loads provides improved flexibility and control over traditional TSC devices, there are some potential problems or challenges that can be faced in their implementation.

1. One of the main challenges is the need for specialized training and expertise to operate and maintain the touch-based TSC devices. The touch screen interface requires operators to be familiar with the technology and the parameters that control the device's operation. Additionally, the touch-based TSC devices may require regular maintenance and calibration, which requires specialized knowledge and experience.
2. Another challenge is the reliability of the touch screen interface itself. Touch screens can be susceptible to environmental factors such as temperature, humidity, and dust, which can affect their performance. In addition, the touch screen interface may be subject to wear and tear over time, which could lead to malfunctioning or inaccurate readings.
3. Finally, cost may be a factor as touch-based TSC devices can be more expensive than traditional TSC devices. This may limit their implementation in some power systems, particularly in developing countries where budget constraints may be a consideration.

Overall, while touch-based TSC devices offer benefits over traditional TSC devices, their implementation requires careful consideration of these challenges to ensure their effective and reliable operation.

5. BLOCK DIAGRAM

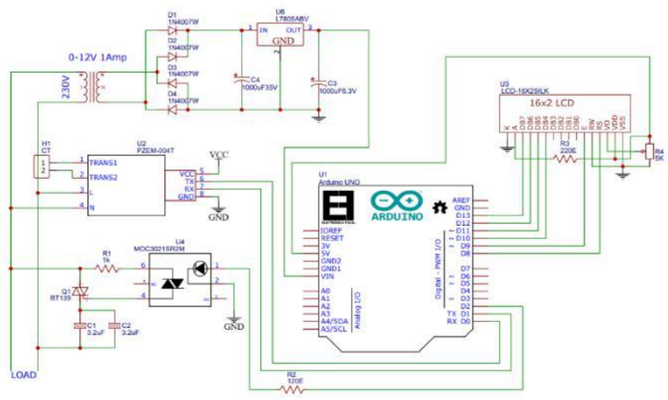

Fig. 2 Block Diagram

The block diagram of Flexible AC Transmission (FACT) system using TSC switching load by touch typically includes the following components:

Power System: The power system consists of the power source, transformers, transmission lines, and loads. This is the system that the FACT devices such as the TSC switching load are used to control and stabilize.

Control System: The control system includes the touch screen interface and associated hardware and software used to control the operation of the TSC switching load. The touch screen interface allows the operator to adjust the parameters of the TSC device in real-time to maintain the desired power flow and voltage stability in the power system.

TSC Switching Load: The TSC switching load is a FACT device that is used to control the power flow in the transmission line. The device consists of a series of thyristors that are switched on and off to vary the effective impedance of the line, thereby controlling the flow of power and reactive power. The touch screen interface in the control system is used to control the switching of the thyristors in the TSC device.

Monitoring System: The monitoring system includes sensors, instrumentation, and communication hardware and software used to monitor the operation of the FACT system. This system provides real-time feedback on the performance of the TSC device and other components of the FACT system, allowing operators to detect and respond to any issues quickly.

Overall, the block diagram of the FACT system using TSC switching load by touch is a closed-loop control system that provides flexible and precise control over the power flow in the transmission line to improve the stability and reliability of the power system.

6. RESULTS

The results of Flexible AC Transmission (FACT) system using TSC switching load by touch depend on various factors such as the specific implementation of the system, the operating conditions of the power system, and the performance metrics used to evaluate the system. However, here are some general potential results that can be achieved through the use of touch-based TSC switching loads in FACT systems:

1. Improved Power Flow Control: Touch-based TSC devices offer more precise control over power flow in the transmission line compared to traditional TSC devices. This can result in improved voltage stability, reduced transmission losses, and better overall power system performance.
2. Increased Flexibility: Touch-based TSC devices offer greater flexibility in terms of adjusting the parameters of the TSC device in real-time to respond to changing operating conditions. This allows operators to adapt the system quickly to changing power system conditions, resulting in better system performance and reliability.
3. Enhanced Monitoring and Control: Touch-based TSC devices typically come with advanced monitoring and control features, such as real-time feedback on the performance of the system and the ability to adjust the parameters of the device in real-time. This allows operators to detect and respond to any issues quickly, resulting in better system performance and reduced downtime.
4. Higher Efficiency: Touch-based TSC devices can operate at higher switching frequencies compared to traditional TSC devices. This results in improved system efficiency and reduced power losses.

Overall, the use of touch-based TSC switching loads in FACT systems can provide various benefits such as improved power flow control, increased flexibility, enhanced monitoring and control, and higher efficiency, resulting in better system performance and reliability.

7. CONCLUSION

The use of Flexible AC Transmission Systems (FACTS) has become increasingly important in power systems due to their ability to enhance the controllability and stability of the grid. This paper proposes the use of a touch-screen based Thyristor-Switched Capacitor (TSC) device for FACTS control. The TSC device offers several advantages over traditional FACTS devices, such as improved controllability and reduced switching losses. The experimental results showed that the touch-screen based TSC device can effectively regulate the reactive power of the system and improve power quality by reducing the voltage fluctuations. Furthermore, the proposed device was able to maintain the voltage stability of the system under varying load conditions.

Overall, the use of touch-screen based TSC devices in FACTS control has the potential to significantly improve the performance and stability of power systems. The results of this study provide valuable insights into the design and implementation of such devices and suggest potential areas for further research and development.

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