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Static Synchronous Series Compensator Controller Using the Sen Transformer Control Strategy

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Abstract: *In an ac transmission line, it is possible to control the active and reactive power transfer independently, by adding series compensation voltage, in both magnitude and phase angle, to the line. A transmission line is connected in series to the Static Synchronous Series Compensator and a solid-state voltage source inverter with associated transformer. In line series, a SSSC imposes a variable amplitude nearly sinusoidal voltage. This injected voltage creates seriatim inductive or capacitive reactance with the line as it is approximately 90° from the line current. The modulated reactance produces this (simulated) varying reactance which modulates the electric power carried through the transmission line. This focus on preliminary research for controller design motivated this study to attempt further development of the SSSC and VSC models.*

Keywords: *FACTS, SSSC, VSC, SEN Transformer, Reactive Power*

I. Introduction

Transmission Voltage haul Network The backbone of electrical power transmission consists of bundles assignment of three w phase ac transmission lines of discrete transmission voltages. Transmission voltages keep rising as the capacity to transmit power or the distances between transmission points increase. In fact, elevation of transmission voltages are inversely proportional to decreasing the levels of turns in transmission. The power-electronics controller based FACTS system adds up the power flow in transmission networks by possibility of efficient usage of the networks [2-3]. Due to their very fast response, these controllers enhance the safety margins of the operation of a gearbox system without causing stability concerns [1].

The operator should be able currently to control the power flow on lines to make the largest safety margin and to transmit the electric power flow at minimum cost of operation, all within the geographical limitations of the current-carrying capacity of the conductor, voltage capacity of tests of insulating electrical devices and structural capacity of the supporting hardware. The latest FACTS device in use for series compensation of transmission lines is the Static Synchronous Series Compensator. The principles of SSSC operation and control are given in [1].

The primary element of SSSC is a DC-AC inverter which is connected in series with the transformer and line, Figure 1. Both the line current and the mentioned earlier injected voltage are almost in quadrature. One can use a small amount of additional voltage that is out-of-phase with the line current and in phase with the line voltage to represent the series reactance of capacitors or inductors in transmission lines [1].

Through the change of electric power flow in the gearbox line, the voltage source injection effect simulates a fluctuating reactance. The impedance compensation controller can be applied in order to counteract the resistance of the transmission line, which operates as negative impedance once an SSSC is connected with an energy storage element. The impedance compensation controller is designed to work like a compensating reactance controller for an SSSC system that is not connected to an energy storage system.

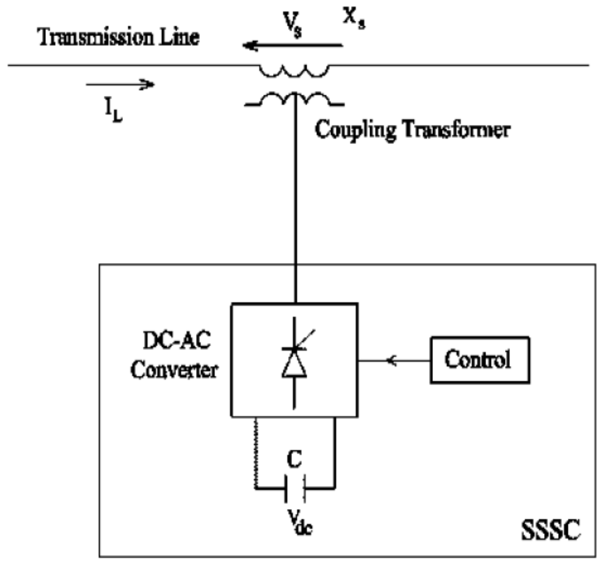

Fig 1: Basic Building block of SSSC

II. Controlling Facts with a Sen Transformer

In phase and Out of phase voltage was wired in series to form the transmission anistropy allowing the voltage to be given in any location in the line [4]. Controlling the voltage at any fixed point along the transmission line is shown in Figure 2 (a). This exciter unit is next and its primary coil is a three-phase Y is coupled to the line voltage, Vs. The voltage-regulating device is equipped with six secondary windings. A compensating voltage Vs is either in contact or without contact out of phase with the line voltage, Vs is generated when the line is altered to possess a voltage, Vs '. We can find the phasor diagram in Figure 2(b).

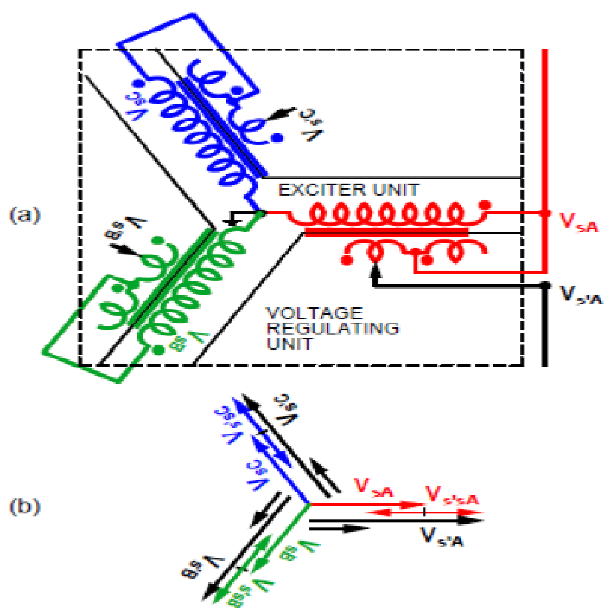

Fig 2: (a) Voltage regulator circuit (b) phasor diagram

From figure 3 any angle as compared to the line voltage can be applied for the connection if there is the need of a series compensation voltage which is variable. In this process, real and reactive power exchange occurs. The compensating voltage, which is created from the line voltage by the action of the transformer on the primary windings, must be transferred to the line through the secondary windings, therefore, the real and reactive power that is exchanged with the line must pass from the line to the line through the secondary windings [1].

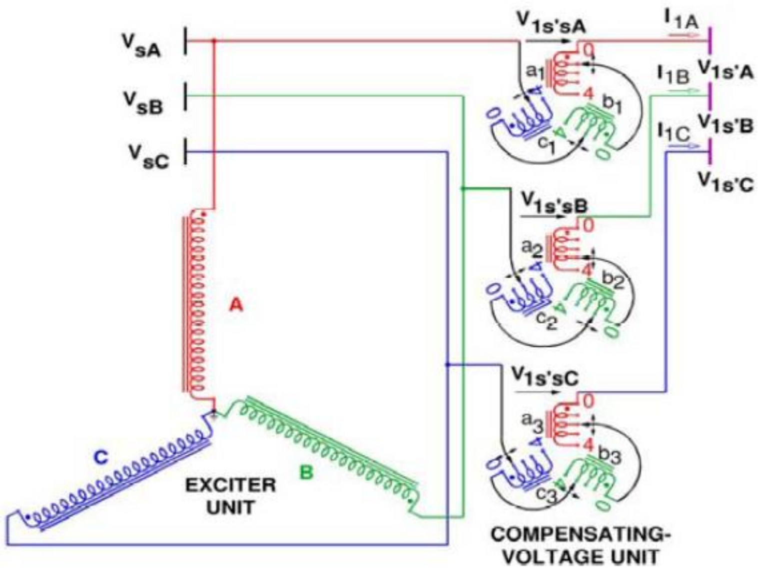

Fig 3: Schematic diagram of "ST"

III. Methodology

Essentially, an AC voltage is received at one end of a voltage-fed converter, and an AC voltage is output at the other end [1]. The frequency of the AC voltage may fluctuate or stay constant based on the application. A voltage-fed inverter should ideally have a reliable input voltage source with a small Thevenin impedance. A large DC capacitor can be connected at the input side to reduce DC voltage fluctuations if the input voltage is unstable [4]. In these simulated tests, a huge capacitor that is separated into two sections is also inserted before the converter. The VSC's block diagram is shown in Figure 4. In-depth explanations of the basic concepts of current source converters and voltage-type source converters have been provided [1].

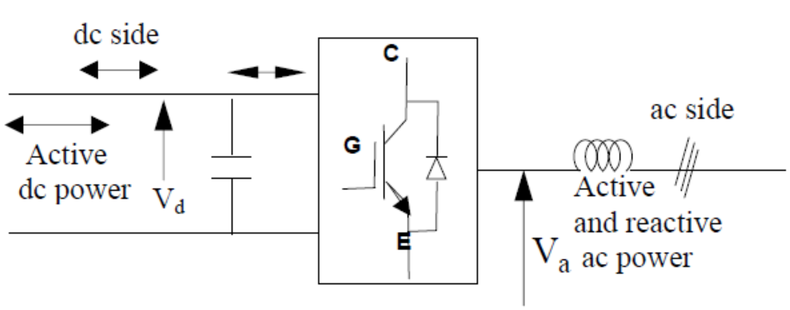

Fig 4: Basic principles of VSC

IV. Conclusion

Though requiring over two times more iterations than Accelerated Particle Swarm optimization, MCI has been shown to give the best results. There has only been a variation in optimization approach attempted. Various other versions involving other MCI flavors in combination with other optimizing techniques might be tried in the future [3]. The aim of this study was to selectively remove four harmonics thus requiring the development of five primary notch angles that could be built upon. X-ray transform of short arc programs may be improved by having higher numbers of notch angles. However, due to the minimal switching losses, experimental results could not be consistent.

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