

Power Flow Control with Static Synchronous Series Compensator (SSSC)

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Abstract

The Static Synchronous Series Compensator (SSSC) which is a Series FACT controller, becomes more attractive due to its superior abilities over the impedance-based series compensation. These superior abilities can only be achieved by appropriate control schemes and controller settings. This paper investigates two control schemes of the SSSC for the power flow control. In the first scheme, which is called Reactance Emulation Scheme, the SSSC performs a function of the series impedance connected to the transmission line. This performance can be achieved by controlling the quadrature voltage of the SSSC in relation to the transmission line current, and the required series impedance compensation. In the second control scheme, which is called Quadrature Voltage Control Scheme, the SSSC injects a quadrature voltage into the transmission line. Three modes of compensation, which are capacitive compensation, inductive compensation, and reverse power flow, can be achieved by controlling the phase angle relationship between the injected voltage phasor and line current phasor, and the magnitude of the compensated voltage. A 12- pulse voltage source converter is chosen as the Voltage Source Converter of the SSSC. Dynamic responses of the SSSC with two control schemes are investigated by the digital simulation of a simple two-bus 115 kV 50 Hz power system with a 150 MVA SSSC installed at the sending end bus. Simulation results illustrate good quality of power regulation of the SSSC under both control schemes. Furthermore, the SSSC with quadrature voltage control scheme shows superior performance over the reactance emulation control scheme for its ability to reverse the power flow of the transmission line.

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