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Missing-Sensor-Fault-Tolerant Control for SSSC FACTS Device with Real-Time Implementation

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Control of power systems relies on the availability and quality of sensor measurements. However, measurements are inevitably subjected to faults caused by sensor failure, broken or bad connections, bad communication, or malfunction of some hardware or software. These faults in turn may cause the failure of power system controllers and consequently severe contingencies in the power system. To avoid such contingencies, this paper presents a sensor evaluation and (missing sensor) restoration scheme (SERS) by using auto-associative neural networks (auto-encoders) and particle swarm optimization (PSO). Based on the SERS, a missing-sensor-fault-tolerant control (MSFTC) is developed for controlling a static synchronous series compensator (SSSC) connected to a power network. This MSFTC improves the reliability, maintainability and survivability of the SSSC and the power network. The effectiveness of the MSFTC is demonstrated by a real-time implementation of an SSSC connected to the IEEE 10-machine 39-bus system on the Real Time Digital Simulator (RTDS) and TMS320C6701 digital signal processor platform. The proposed fault-tolerant control can be readily applied to many existing controllers in power systems.

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