Static synchronous compensator

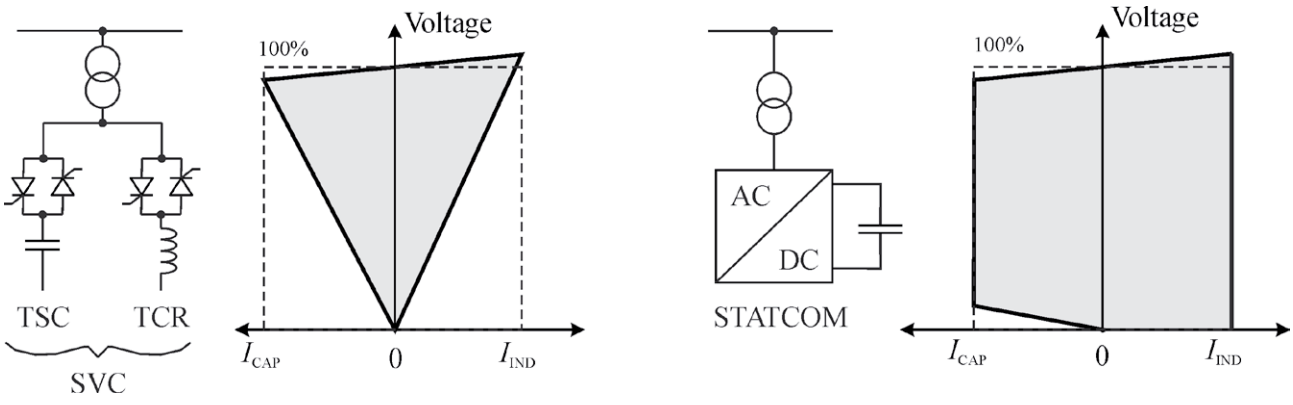
Short-term voltage disturbances may inflict considerable harm in the form of damaged equipment, lost production and reduced productivity. An effective solution for power quality improving is STATCOM, Static synchronous compensator. STATCOM is capable of mitigating voltage sags/swells, imbalance, flicker, harmonics and improving the system capability to ride through fault events.

A typical solution for the continuous control of reactive power is static VAr compensator (SVC), a combination of thyristor-controlled reactor (TCR) and thyristor-switched capacitors (TSC). The reactive power output of SVC is adjustable in the order milliseconds but dependent on the system voltage which limits the ability to mitigate the network voltage instabilities. The new breed of VAr compensators is based on self-commutated AC/DC power converters. Their performance is superior to SVCs, being capable of operating at rated power nearly independent of the system voltage and controlling the reactive power output in the order of microseconds. A representative of converter based VAr compensators is STATCOM, Static synchronous compensator.

STATCOM

STATCOM is a self-commutated AC/DC power converter connected in parallel with the power system through coupling reactors. The power electronic switches of the converter are controlled to produce approximately sinusoidal output AC-voltages, being in phase with the mains voltages, from the DC-source. Depending on the magnitude of the AC-voltages produced the VARs are either generated or absorbed.

STATCOM provides a superior solution for VAr control, voltage regulation, flicker compensation, and fault-ride-through improvement. Also grid current harmonic filtering is possible if sufficiently high switching frequency can be used. Typical applications include flicker compensation of large industrial loads



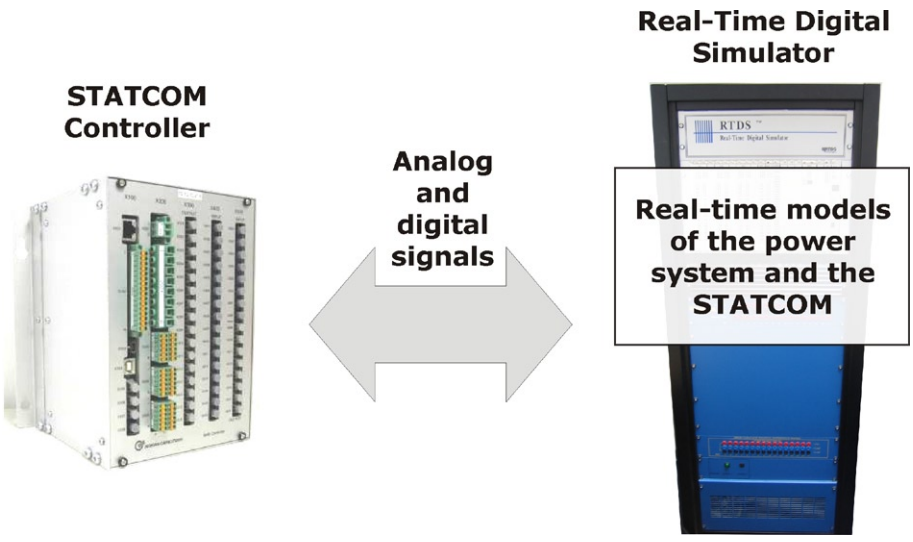
Reactive current output range of Static VAr Compensator (SVC) and Static Synchronous Compensator (STATCOM).

ADINE is a project co-funded by the European Commission

such as arc furnaces and VAr control of wind farms. Benefits of STATCOM are improved power quality and network stability, increased transmission capacity, and improved fault-ride through capability and grid code compliance of renewable generation.

Hardware-in-the-loop simulation of STATCOM

Hardware-in-the-loop (HIL) simulation is a technique used in the development and testing of embedded systems. In Adine-project HIL simulation is used in the testing of STATCOM controller. The tests are based on the Real-Time Digital Simulator (RTDS) which is a multiprocessor power system simulator capable of HIL simulations with latency times below 2 µs. The models of the power system and the STATCOM studied are implemented in the RTDS. The STATCOM controller interfaces the RTDS simulation through analog and digital I/O's of the RTDS hardware. The analog voltage and current measurements required in the STATCOM control are output from the simulation and passed to the controller that performs the control routines. In order to achieve the desired STATCOM current and voltage the controller adjusts the gating signals that control the power electronic switches of the STATCOM in the RTDS simulation. With the help of HIL simulations the controller operation can be tested and verified prior to real-life demonstration.



Principle of hardware-in-the-loop simulation of STATCOM

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