STATCOM

- A STATCOM is a controlled reactive-power source. It provides the desired Reactive-power generation and absorption entirely by means of electronic processing of the voltage and current waveforms in a voltage-source converter (VSC).
- A single-line STATCOM power circuit is shown in Figure(a), where a VSC is connected to a utility bus through magnetic coupling.
- In Figure.(b), a STATCOM is seen as an adjustable voltage source behind a reactance—meaning that capacitor banks and shunt reactors are not needed for reactive-power generation and absorption, thereby giving a STATCOM acompact design, or small footprint, as well as low noise and lowmagnetic impact.
- The exchange of reactive power between the converter and the ac system can be controlled by varying the amplitude of the 3-phase output voltage, Es, of the converter, as illustrated in Figure(c).
- That is, if the amplitude of the output voltage is increased above that of the utility bus voltage, Et, then a current flows through the reactance from the converter to the ac system and the converter generates capacitive- reactive power for the ac system.
- If the amplitude of theoutput voltage is decreased below the utility bus voltage, then the current flows from the ac system to the converter and the converter absorbs inductive-reactive power from the ac system.
- If the output voltage equals the ac system voltage, the reactive-power exchange becomes zero, in which case the STATCOM is said to be in a floating state.
- On the basis of explanations provided in the previous sections it should be clear to the reader that, on the one hand, in the linear operating range the V-I characteristic and functional compensation capability of the STATCOM and the SVC are similar.
- However, the basic operating principles of the STATCOM, which, with a converter based var generator, functions as a shunt-connected synchronous voltage source,are fundamentally different from those of the SVC, which, with thyristor-controlled reactors and thyristor-switched capacitors, functions as a shunt-connected, controlled reactive admittance.
- This basic operational difference (voltage source versus reactive admittance)accounts for the STATCOM's overall superior functional characteristics, better performance, and greater application flexibility than those attainable with the SVC.

- These operational and performance characteristics are summarizedhere, with the underlying physical reasons behind them, and with the corresponding application benefits.

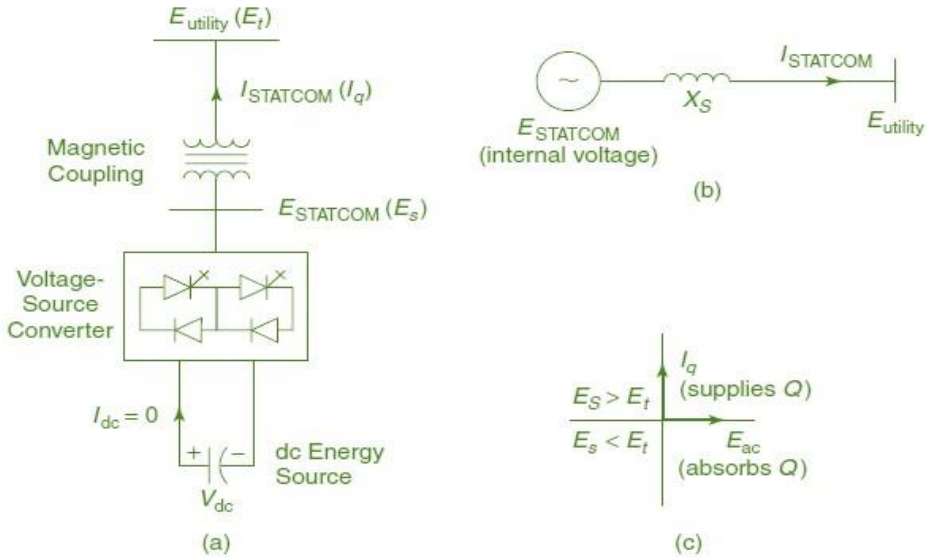

Figure 10.1 The STATCOM principle diagram: (a) a power circuit; (b) an equivalent circuit; and (c) a power exchange.

V-I and V-Q Characteristics

- The STATCOM is essentially an alternating voltage source behind a coupling reactance with the corresponding V-I and V-Q characteristics shown in Figure.
- These show that the STATCOM can be operated over its full output current range even at very low (theoretically zero), typically about 0.2 p.u system voltage levels.
- In other words, the maximum capacitive or inductive output current of the STATCOM can be maintained independently of the ac system voltage , and the maximum var generation or absorption changes linearly with the ac system voltage.
- In contrast to the STATCOM, the SVC, being composedof (thyristor-switched capacitors and reactors, becomes a fixed capacitive admittance at full output.
- Thus, the maximum attainable compensating current of the SVC decreases linearly with ac system voltage, and the maximum var output decreases with the square of this voltage ,as shown in Figures
- (b) and (b), respectively. The STATCOM is, therefore superior tothe SVC in providing voltage support under large system disturbances during which the voltage excursions would be welloutside of the linear operating range of the compensator.

- The capability of providing maximum compensating current.at reduced system voltage enables the STATCOM to perform in a variety of applications the same dynamic compensation as an SVC of considerably higher rating.

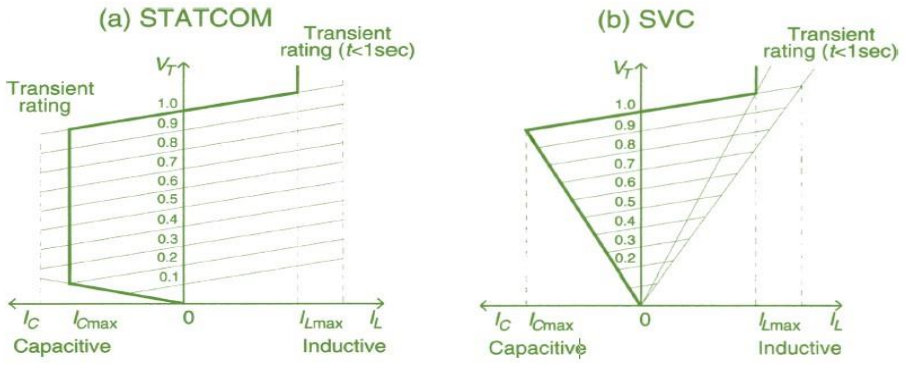

Figure 5.59 *V-I* characteristic of the STATCOM (a) and of the (SVC) (b).