Presentation on SVC Modelling

Sub Title:- Modeling for Load flow Studies

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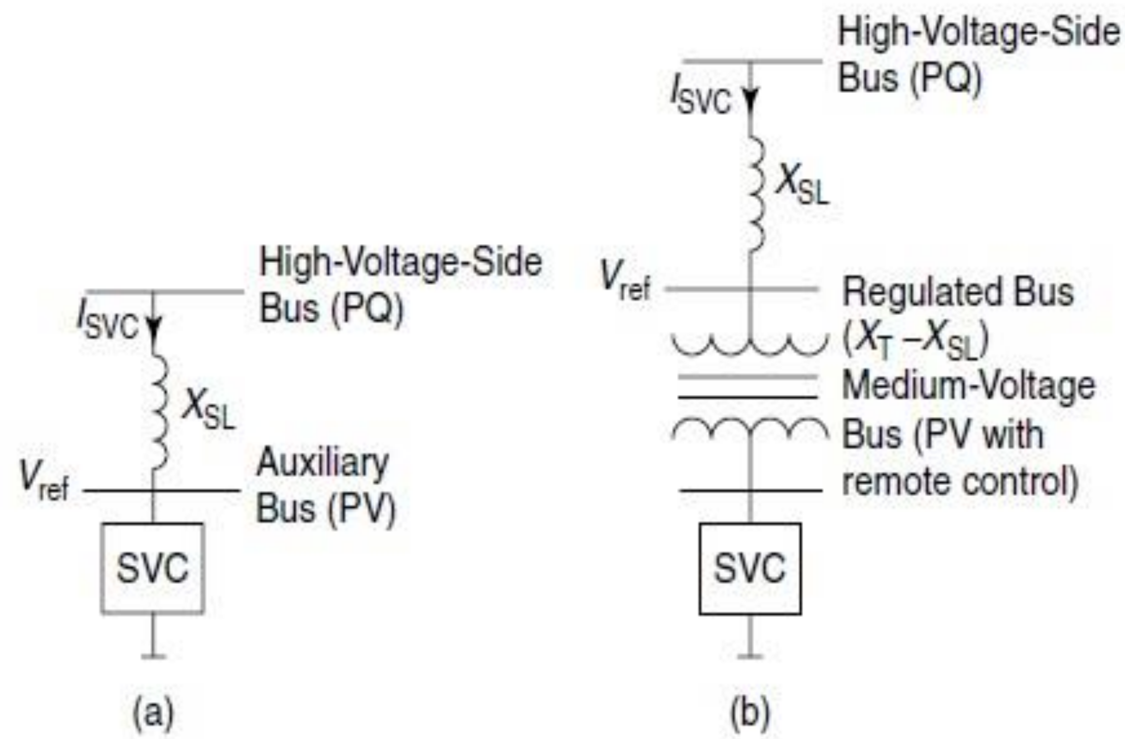
The SVC models in these studies should represent the fundamental-frequency, steady-state, and balanced performance of the SVC It may be necessary to model the SVC in terms of its three individual phases when an unbalanced operation of the SVC is considered, such as during load compensation or voltage balancing

SVC Operation Within the Control Range

If the slope of the SVC is neglected, then the SVC is modeled as a PV bus, with P=0 and $V=V_{ref}$ However, if the slope is considered (as in the analysis of weak ac systems), the same is modeled by connecting the high-voltage side of the SVC bus to a fictitious auxiliary bus by means of a reactance equal to the slope expressed in per units on the SVC base.

SVC models with slope representation using conventional power flow PV buses:



(a) without a coupling transformer and (b) with a coupling transformer.

It may become necessary to model the coupling transformer should the SVC be connected to the tertiary winding. When the transformer is represented explicitly, the susceptance range of the SVC must be appropriately adjusted to represent the correct reactive-power rating as seen at the high-voltage bus The corresponding load-flow model is illustrated in Figure (b).

SVC Operation Outside the Control Range

The SVC is represented as an appropriate shunt admittance, depending on which limit is violated If $I_{SVC} > I_{max}$ (the inductive-limit violation), then $B = B_{min} = - Q_{max}/V^2_{max}$ (1)

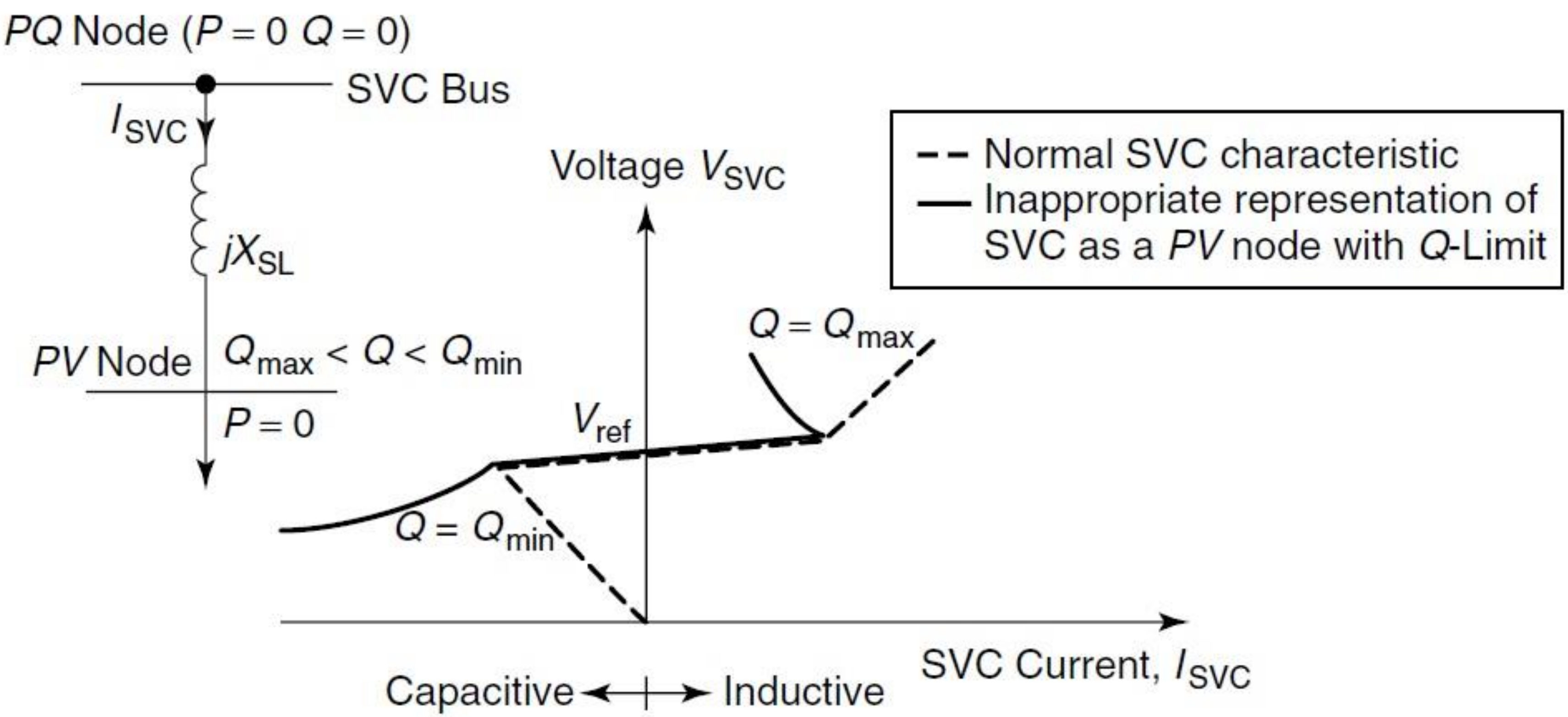
If $V < V_{min}$ (the capacitive-limit violation), then

$B = B_{min} = - Q_{min}/V^2_{min}$ (2)

where Q_{max} = the maximum inductive-reactive-power rating at $V_{SVC} = V_{max}$

Q_{min} = the maximum capacitive-reactive-power rating at $V_{SVC} = V_{min}$

Inappropriate SVC modeling outside the control range for load-flow studies



Modeling for Small- and Large-Disturbance Studies

In these studies, only the positive-sequence behavior of the SVC-compensated system is modeled. The electromagnetic transients in the SVC (TSC, TCR) and the network can be neglected if the objective is to investigate the stability related to electromechanical oscillations.

Variable-susceptance model

In this model the SVC current in response to the susceptance output is given by

$$I_{SVC} = B_{ref} V_{SVC}$$

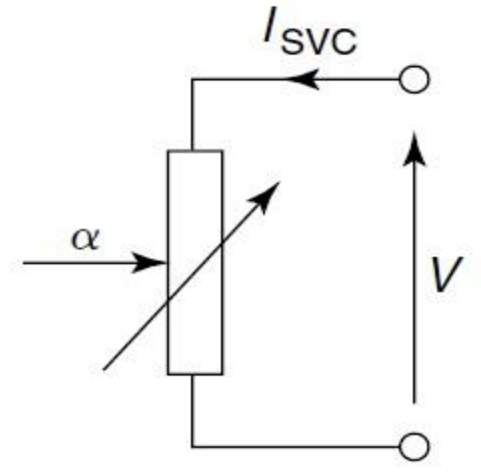


Figure:- Basic static var generator models for small- and large-disturbance studies the susceptance model

Controlled-current-source model

In this model the SVC current is again given as

$I_{SVC} = B_{ref}V_{SVC}$

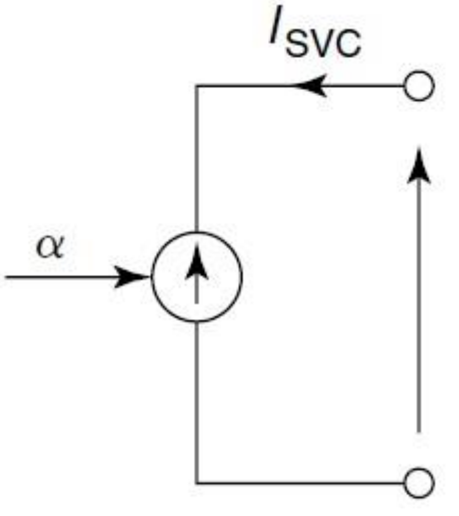


Figure:-Basic static var generator model for small- and large-disturbance studies the current-source model.

In both models in the preceding list are equivalent, a significance difference exists in their implementation. In case of the variable-susceptance model, the system-admittance matrix **B must be updated in case any changes** occur in Bref, whereas a constant **B matrix can continue to be used in case of** the controlled-current-source model.

Modeling for Subsynchronous Resonance (SSR) Studies

In sub synchronous resonance (SSR) studies, a wide bandwidth of electromechanical frequencies is considered, so a need exists to model the network transients, as well as the thyristor-controlled and thyristor-switched elements. Additional filtering in the measurement systems may be required to eliminate network-resonant frequencies close to fundamental for the satisfactory, stable operation of the SVC control system.

Modeling for Electromagnetic-Transient Studies

The requirements for modeling the SVC in a general electromagnetic-transient study are

1. representation of three phases;
2. accuracy over a wide frequency range;
3. Representation of all system nonlinearities, as well as different controls and protection functions;
4. time-domain simulation;

Modeling for Harmonic-Performance Studies

The basic SVC model required for conducting harmonic-performance studies comprises an ideal harmonic-current source (single-phase or 3-phase symmetrical) with a specified current spectrum. The magnitudes of the nth order harmonic current, In, are dependent on the SVC configuration and its operating condition.

Thank You