# HOMEWORK # 3 - Deadline : November 25, 2019

Under the phasor approximation, an "injector"[1] is modelled as :

$$\boldsymbol{\Gamma}\,\dot{\boldsymbol{x}} = \boldsymbol{f}(\boldsymbol{x}, v_x, v_y, \boldsymbol{p}) \qquad \text{with} \quad \boldsymbol{x}(0) = \boldsymbol{x}^o \tag{1}$$

where:

- $\dim \boldsymbol{x} = \dim \boldsymbol{f} = n$
- $\boldsymbol{\Gamma}$ is an $n \times n$ matrix with : $\quad \Gamma_{ij} = 1$ if the $i$-th equation gives $\dot{x}_j$; $\quad = 0$ otherwise.
- $v_x$ and $v_y$ are the components of the terminal voltage
- the state vector $\boldsymbol{x}$ includes $i_x$ and $i_y$, the components of the current injected in the network:

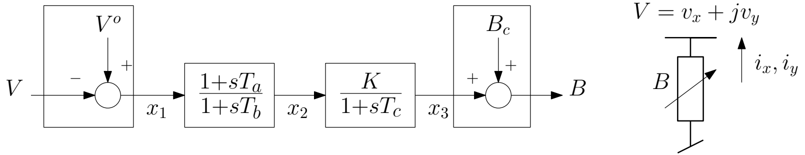
$$\boldsymbol{x} = [i_x, i_y, \ldots]^T$$

- $\boldsymbol{p}$ is a vector of parameters, considered constant in the model.

[1]see slide # 16 of lecture "Power system modelling under the phasor approximation"

Consider a Static Var Compensator (SVC) represented by a variable shunt susceptance $B$, controlled as shown in the block diagram below.

$V^o$ is the voltage set-point. $B_c$ is a known, fixed shunt susceptance.




$V$ is the magnitude of $\bar{V}$ known parameters: $T_a, T_b, T_c, K, B_c > 0$

Assume the model is treated by an *automatic* "equation generator", treating the equations of each block *independently*, i.e. the model of each block may only involve : the input state, the output state and possibly additional internal states.

Write down the SVC model in the form (1) with :

$$\mathbf{x} = [i_x, i_y, x_1, x_2, x_3, \text{internal states}]^T$$

At $t = 0$, the compensator is in steady state and produces a reactive power $Q^o$ under a voltage $V^o$. Determine the initial state vector $\mathbf{x}(0)$ and the set-point $V^o$.