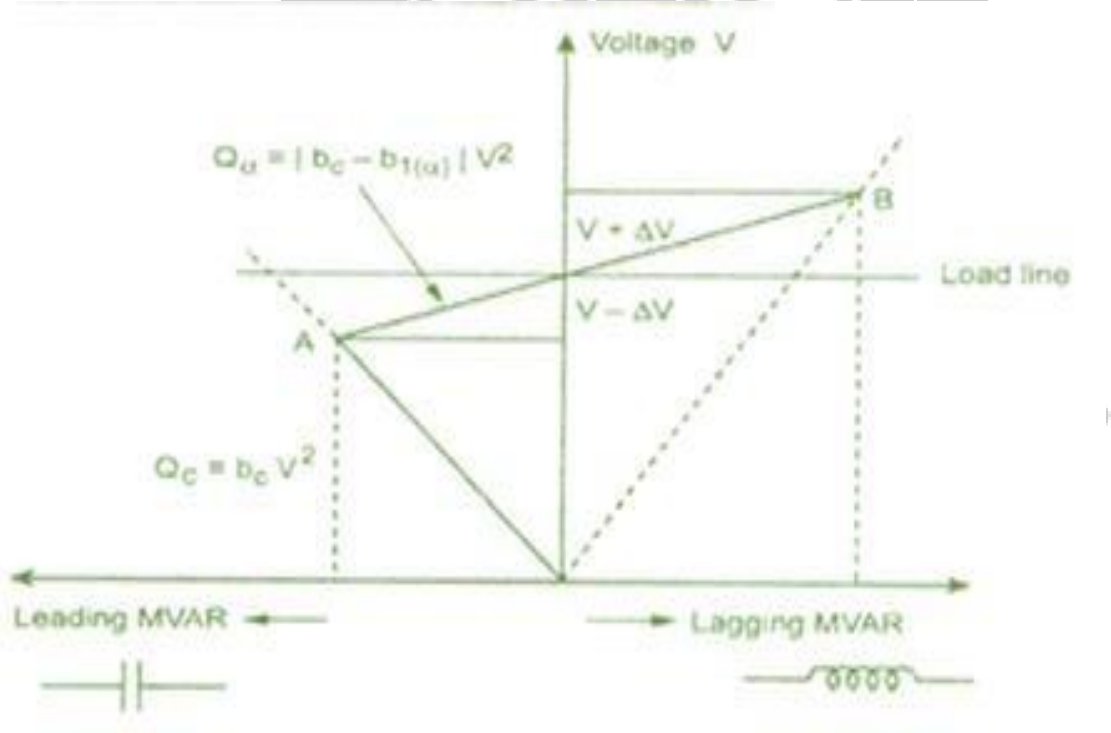
# Fixed Capacitor and Thyristor Controlled Reactor [FC – TCR]

- The circuit diagrams of a FC – TCR, with switched filtersare as shown in figure. This arrangement provides discrete leadings VARs from the capacitors and continuously lagging VARs from thyristor controlled reactor.
- The capacitors are used as tuned filters, as considerable harmonics are generated by thyristor control.
- The steady state characteristics of a FC – TCR is shown in figure. The control range is AB with a positive slope, determine by the firing angle control.

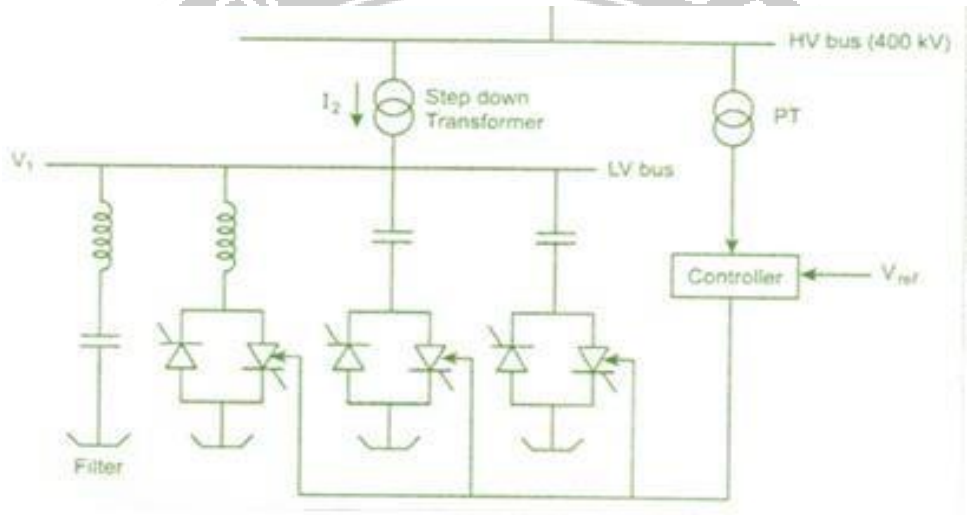
$$Q\alpha = \left| b_c - b_{1(\alpha)} \right| V^2$$

- Where bc is the susceptance of the capacitor, b1(α) isthe susceptance of the inductor at firing angle α.
- As the inductance is varied, the susceptance varies overa large range. The voltage varies within limits V ± ΔV. Outsidethe control interval AB, the FC – TCR acts like an inductor in thehigh voltage range and like a capacitor in the low voltage range.
- The response time is of the order of one or two cycles. The compensator is designed to provide emergency reactive and capacitive loading beyond its continuous steady state rating.



## Thyristor Switched Capacitor and Thyristor ControlledReactor [TSC – TCR]

- To control the current through a reactor, with new elements Thyristor Controlled Reactor (TCR) and Thyristor Switched Capacitor (TSC) to meet reactive power generationand absorption demands.
- Improved performance under largesystem disturbance and lower power loss are obtained.

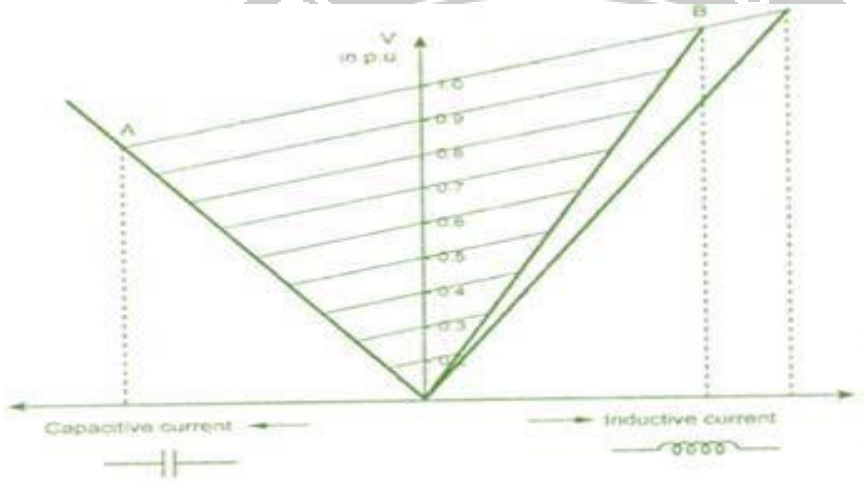



**TSC-TCR**

- Each thyristor switch is built up from two thyristor stacks connected in anti-parallel.
- Each single phase thyristor switchedcapacitor consists of the capacitor, thyristor switch and reactorto limit the current through the thyristors and to prevent resonance with the network as shown in figure.
- The problem of achieving transient free switching ON ofthe capacitor is overcome by keeping the capacitor charged to the positive or negative peak value, when they are in the stand by state.
- The switching on instinct is then selected at thetime when the network has its maximum or minimum value and the same polarity as the capacitor voltage. Switching of the capacitor is accomplished by separation of the firing pulses to the anti-parallel thyristors so that the thyristors will block as soon as the current becomes zero.
- The capacitor will then remain charged to the positive or negative peak voltage and be prepared for the new transientfree switching on.
- The V-I characteristics is as shown in figure. A certain short time overload capability id

provided both in the maximum inductive and capacitive regions.

- Voltage regulation with a given slope can be achieved in the normal operating range.
- The maximum capacitive current decreases linearly withthe system voltage and the SVC becomes a fixed capacitor when the maximum capacitive output is reached.
- The voltage support capability decreases with decreasein system voltage.




**VI characteristics of an SVC (TSC-TCR)**

***ADVANTAGES***

- SVCs are suited to control the varying reactive power demand oflarge fluctuating loads (i.e., rolling mills and arc furnaces).
- It is used in HVDC converter stations for fast control of reactivepower flow.
- The midpoint voltage will vary with the load and an adjustablemidpoint susceptance is required to maintain constant voltagemagnitude.
- The transmitted electrical power can be increased be capacitiveVARs when the machine accelerates and it can be decreased byreactive VARs when the machine decelerates because it has no inertia.
- Less maintenance.
- Possibility to regulate the phases individually