High Power Converters

SVC using TSC & FC-TCR's

One TSC and two identical FC-TCR's have been used to control the midpoint voltage of a 220KV transmission line from 0.7pu to 1.3pu

The configuration of TSC and FC-TCR is as follows

TSC

Resistance (R) = 10 Ω

Inductance (L) = 339.7539 mH

Capacitance (C) = 3.3135 µF

FC-TCR

Resistance (R) = 1 Ω

Inductance (L) = 517.59 mH

Fixed Capacitance (C) = 3.3135 µF

Fixed Inductance (L) = 122.3114 mH

Fixed Resistance (R) = 10 Ω

Plots:

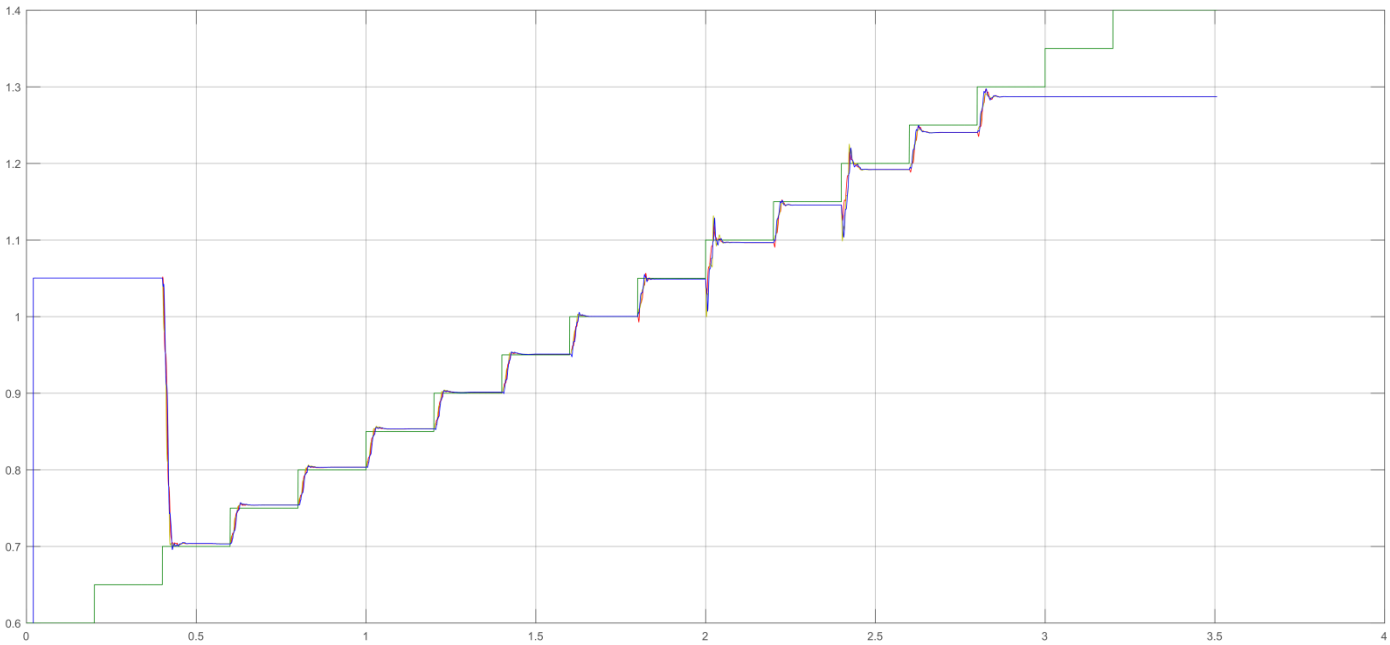


Fig : SVC following changes in reference voltage from 0.7pu to 1.3pu

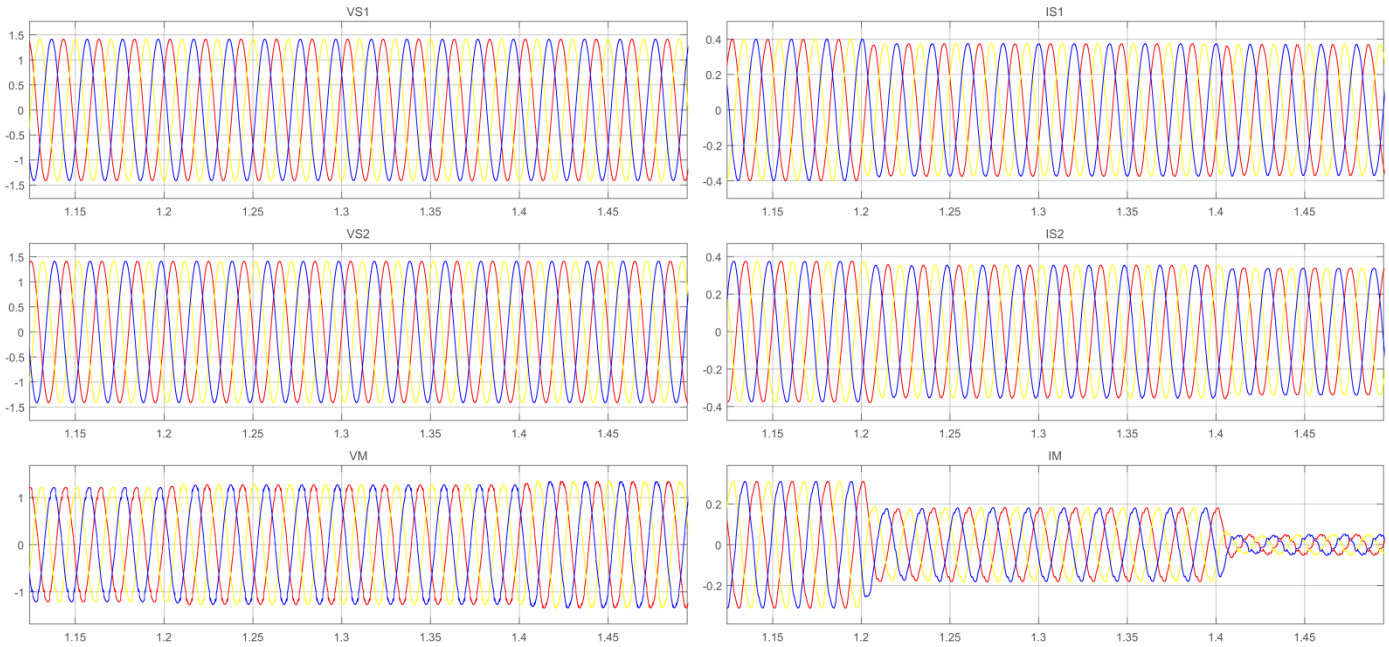


Fig : Voltage and current waveforms

STATCOM

STATCOM has been used to control midpoint voltage of a 220KV transmission line from 0.7pu to 1.3pu.

Following control strategies are used to control STATCOM

- Direct Control Approach
- Indirect Control Approach

Three phase inverter is operated using **Space vector modulation (SVM)**

STATCOM Equipment Ratings:

Sampling time for SVM = 200 μ-seconds

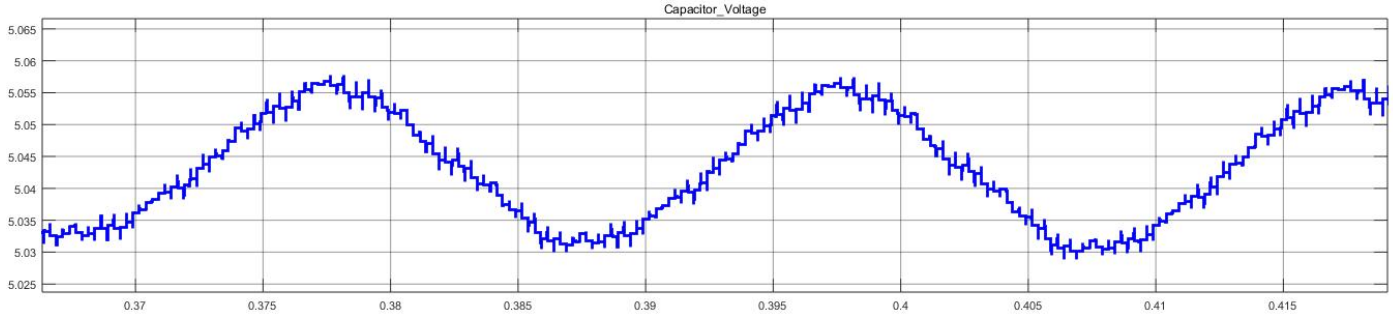
Transformer (1:10) Inductance referred to LV side = 445.6 μH

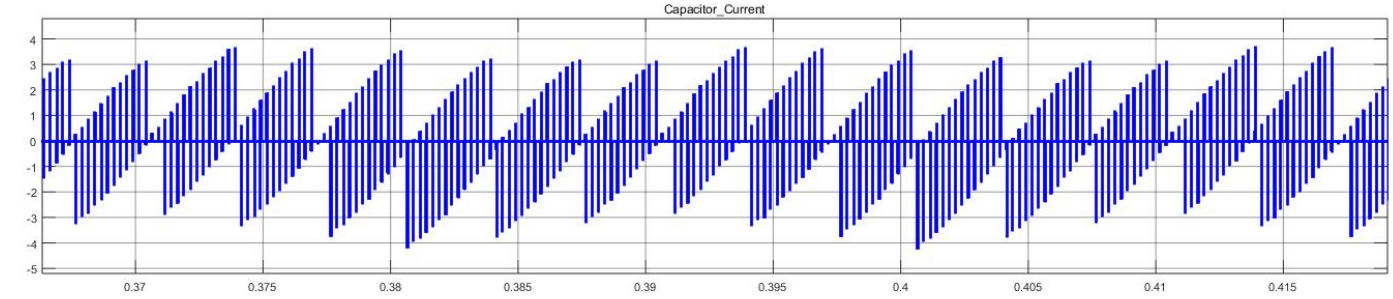
Transformer Resistance referred to LV side = 0.1 Ω

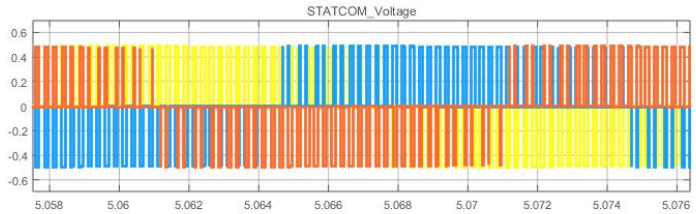
Capacitor = 2.4 mF

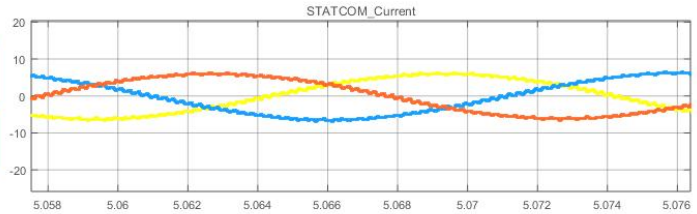
Initial DC Voltage of capacitor = 22.5 KV

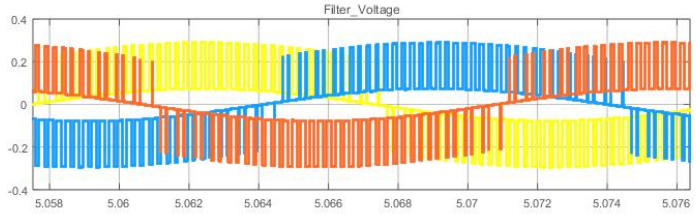
Direct Control of STATCOM

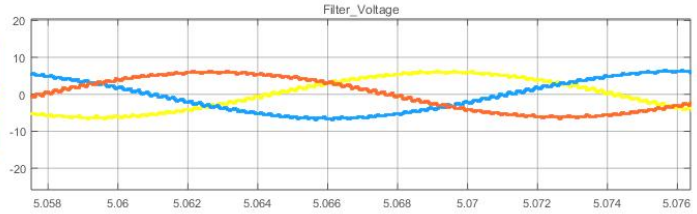


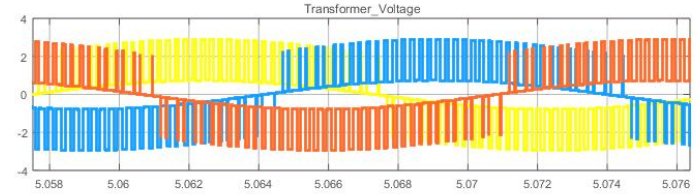


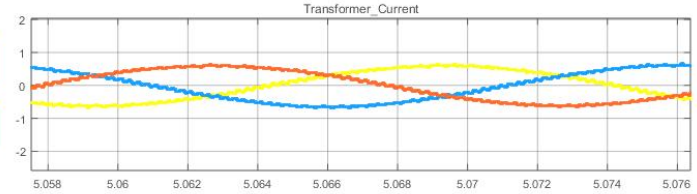


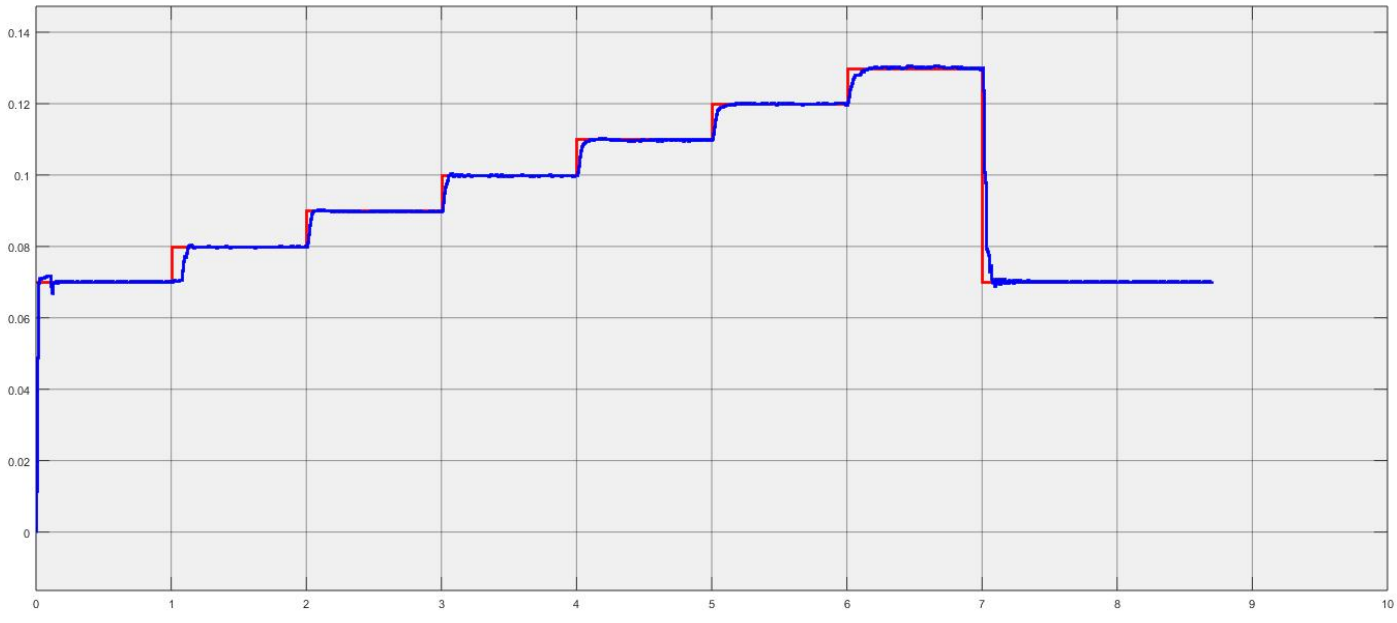




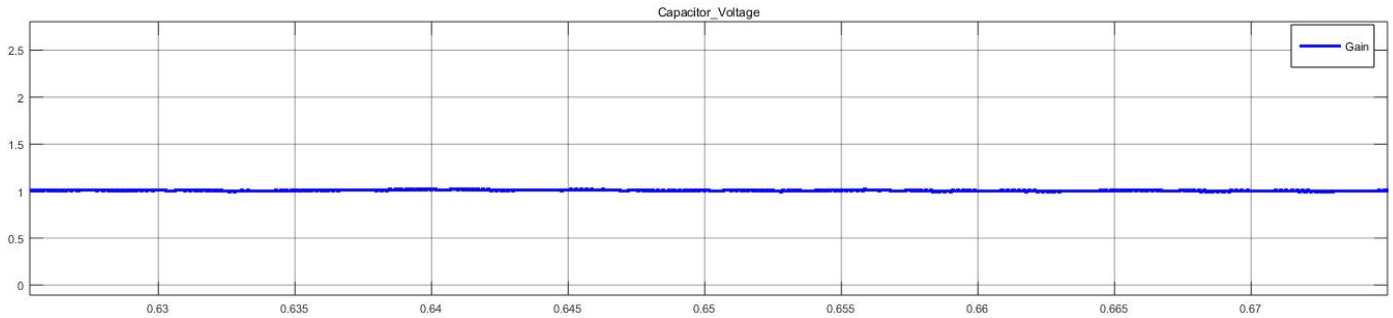


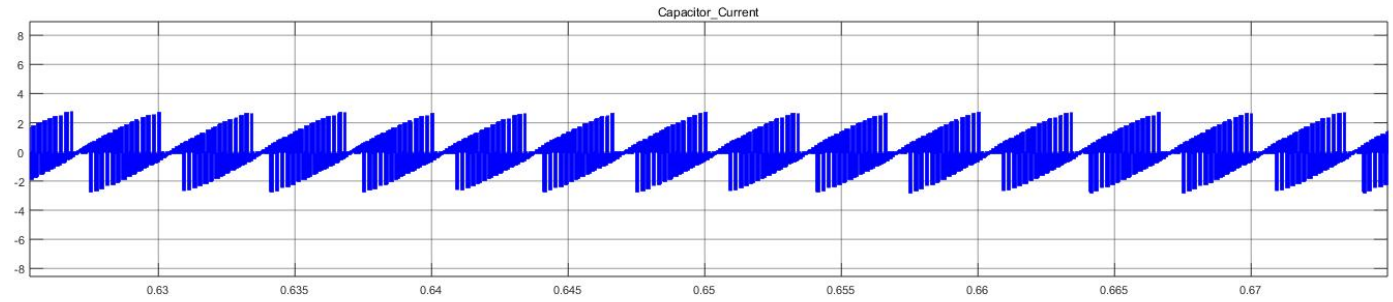


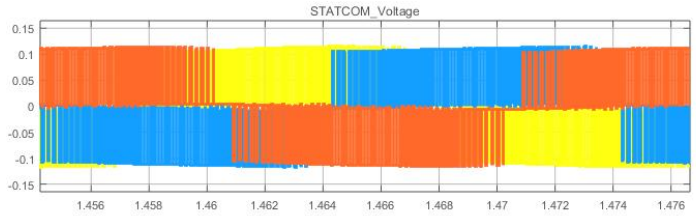


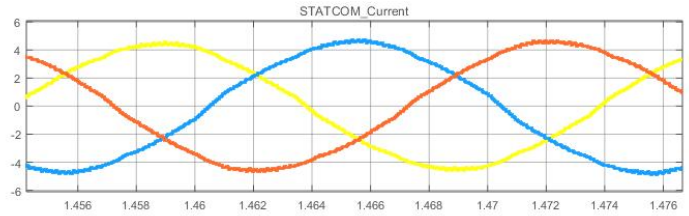


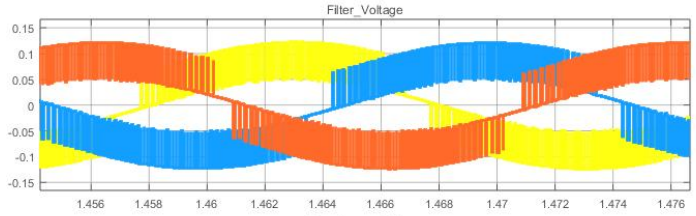
Indirect Control of STATCOM

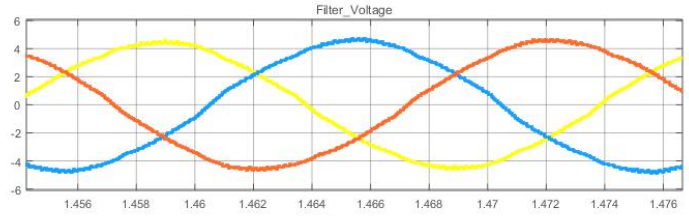


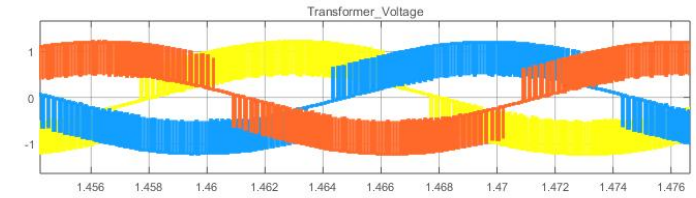


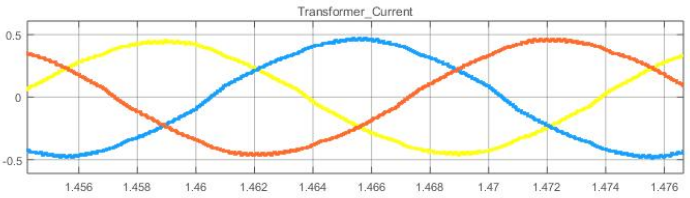


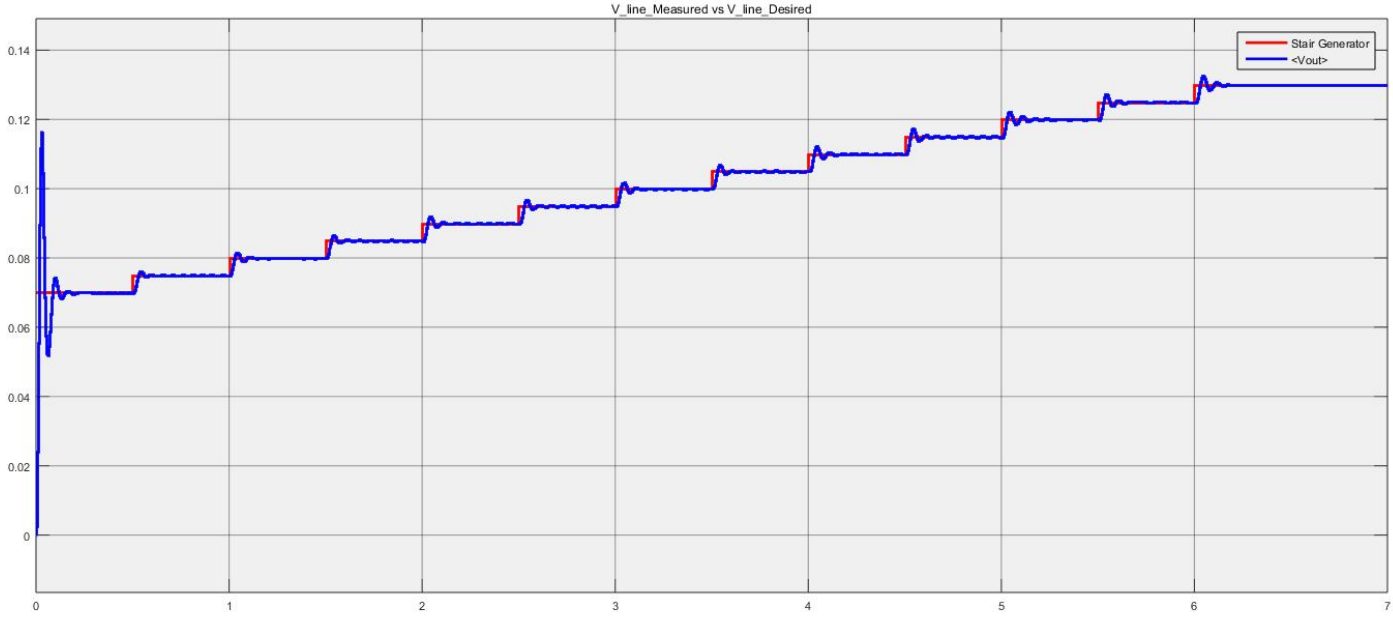












Observations:

- SVC control is slow and sluggish as compared to STATCOM.
- SVC induces harmonics to grid, low order harmonic filters are applied to eliminate fifth harmonic as dominant.
- Indirect control scheme of STATCOM is slow as it involves charging of capacitor from grid.
- Expansion of the system from the range provided in problem statement can be extended easily in STATCOM, however, for SVC designing of passive components for TSC and TCR as well as filters need to be designed.