

## Laboratory Experiment 9

### Voltage Regulation

#### Objectives:

- 1) To study the effect of real and reactive powers on bus voltages.
- 2) Understanding the operation of a Thyristor Controlled Reactor (TCR).

#### Laboratory Tasks and Report:

1. In the PowerWorld example **VoltageRegulation.pwb**, vary the reactive power consumed at Bus 3 in a range from 300 MAVR to -300 MVAR and plot its effect on voltage magnitudes at Buses 3 and 2. Both line MW (green arrows) and MVAR (blue arrows) are shown. Note the direction of line MVAR flow on lines 1-3 and 2-3 as the load MVAR is changed.

The generator at bus 2 has an upper MVAR limit of +250 MVAR and a lower MVAR limit of -200 MVAR. When does it hit the upper MVAR limit, what happens after the limit is hit (note the bus voltage and the MVAR output of the generator at bus 2).

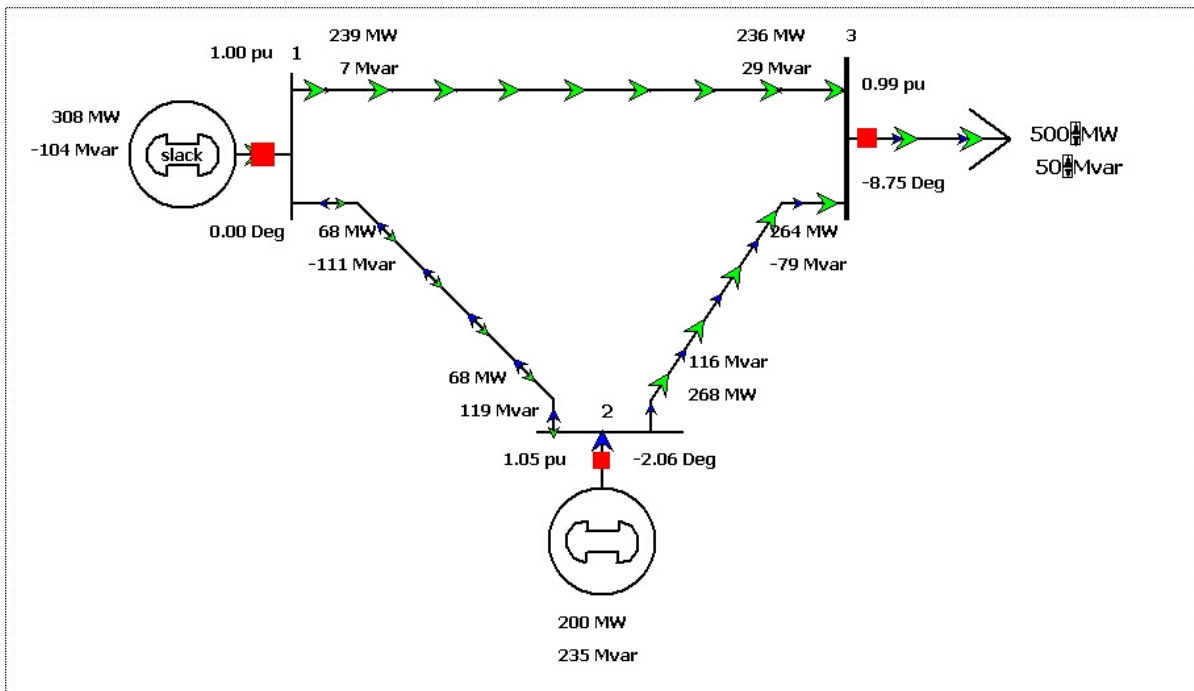
2. The TCR is modeled in the *PSCAD/EMTDC* file **TCR.psc** (see video clip# 12).

A TCR is a “variable reactor” which can be used in a power system to vary the amount of inductive reactance connected to a bus.

The TCR is to be connected to a bus in a power system where it can absorb reactive power from the bus. In the model in **TCR.psc** the bus is represented by a voltage source with a resistance of 0.1 ohm. The amount of reactive power drawn by the variable reactor is controlled by the angle “Alpha” which can be adjusted using the mouse. The MVAR is seen on the display next to the Alpha adjustment box.

Plot the reactive output versus the angle Alpha from Alpha = 90 deg to Alpha = 180 deg. Show the pulse plots for Alpha = 90 deg and for Alpha = 180 deg and explain how changes in the current waveform are related to changes in reactive power.

## VoltageRegulation.pwb



## TCR.psc

