

Laboratory Experiment 5

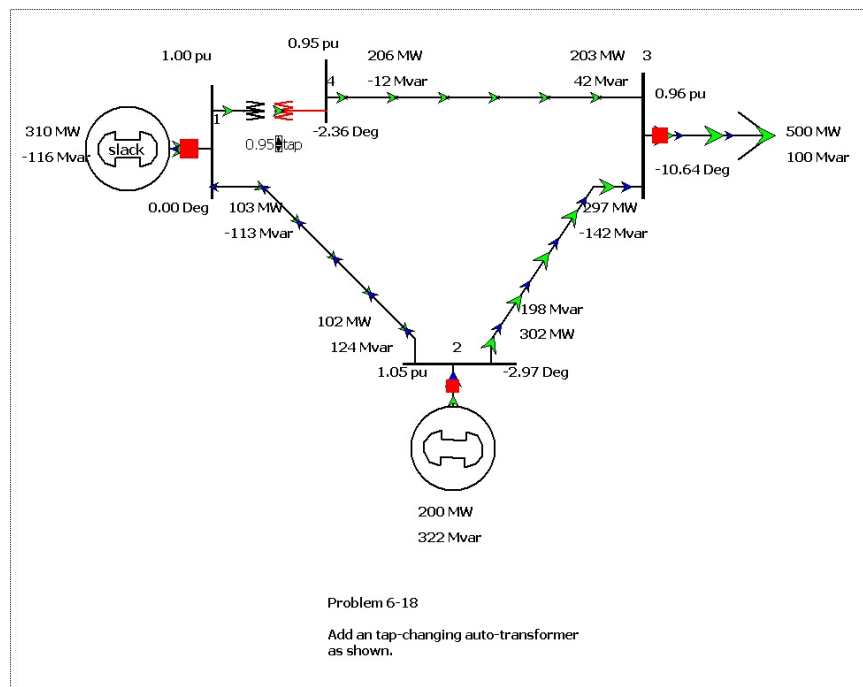
Including Transformers in Power Flow using PowerWorld and Confirmation by MATLAB

Objectives: To look at the influence of including a tap-changer and a phase-shifter on power flow and bus voltages.

Laboratory Tasks and Report:

1. Including a Tap Changer (**PowerFlow_AutoTransformer.pwb**; see video clip# 7)
 - a. An Autotransformer is added between buses 1 and 4 (newly created) as shown in the *PowerWorld* file **PowerFlow_AutoTransformer.pwb**, which is located in this Folder. Double click on this file or open it through *PowerWorld*. The tap-ratio between buses 1 and 4 is such that $n_1/n_4 = 0.95$. Compare this case with that in Example 5-4 for the various bus voltages and the power flow on various lines due to this tap ratio.
 - b. An autotransformer is used to control voltage on one bus of the transformer. You should click on the arrows to change this tap until the voltage at bus 4 is raised to 1.05 pu. What does raising this tap do to the reactive flows? How does raising the tap affect the reactive output of each generator?
 - c. Represent this auto-transformer by means of a pi-circuit of Fig. 6-17b in a MATLAB program, using the results of part a (that is with tap at 0.95), to confirm the results of part a.

PowerFlow_AutoTransformer.pwb



2. Including a Phase-Shifter (**PowerFlow_PhaseShift.pwb**; see video clip# 7)
 - a. A phase-shift transformer is added between buses 1 and 4 (newly created) as shown in the *PowerWorld* file **PowerFlow_PhaseShift.pwb**, which is located in this Folder. Double click on this file or open it through *PowerWorld*. The phase-shift between buses 1 and 4 is such that $V_1 \angle 0^\circ$ results in $V_4 \angle -15.76^\circ$ when the tap is at -14.99° . Compare this case with that in Example 5-4 for the various bus voltages and the power flow on various lines due to this phase shift.
 - b. The phase shift transformer is used to control power flowing through the transformer. Click on the tap adjustment until the MW flowing from bus 4 to bus 3 is exactly 100 MW at the bus 4 end of the 4-3 line. What is the effect on the MW flows on the other two lines, what if any, is the effect of this tap change on the reactive flows on the other lines.
 - c. Represent this phase-shift transformer by means of Eq. 6-32 in a MATLAB program, using the results of part a (that is with the tap at the initial value of -14.99°), to confirm the results of part a.

PowerFlow_PhaseShift.pwb

