Lab 3: Voltage Stability Accessment

ECE 433 – Power Systems Stability and Transients

# Postlab Questions

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| **Name** | **Student ID** | **CCID** | **Lab Section** |
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## Questions

#### P-V Curves

Q1. Why should the PowerWorld Simulator software initialize from a 'flat start' when attempting to solve the system?

Q2. For a system solution the P-V curves can be plotted for different buses. Do all of these P-V curves have the same nose point? Explain.

Q3. If instead only the active power is scaled up to construct the P-V curves another set will be obtained. Sketch qualitatively (no simulation is needed, draw based on your theoretical expectation) the following two curves in one chart and explain the differences.

* The P-V curve when both the active and reactive power are scaled up as was done in the labs procedure.
* The P-V curve when only the active power is scaled up.

#### Adding a New Transmission Line

Q4. What is the impact on the system when a identical parallel transmission line is added to one of branches, explain what effect this has on the buses P-V curves?

Q5. Explain why adding a identical parallel transmission line to a branch halves the impedance of that branch. If the transmission line was also modeled with a shunt admittance (the shunt branch of the common pi circuit for a transmission line), what is the impact of adding a line on that admittance?

Q6. Are there any other methods to reduce a transmission lines series impedance? Name at least one and explain how that method reduces the overall series impedance of a branch.

#### Limiting Reactive Power Capacity

Q7. Are there any differences in system voltages between the 'Limiting Reactive Power Capacity' case and the original 'Base Case' used to create the first P-V curves? Explain.

Q8. What is the impact of a generators maximum reactive power limit on a systems overall capability? Explain.

Q9. Explain what causes a generator to have a maximum reactive power limit.

#### Impact of Shunt Capacitor

Q10. Are there any differences in system voltages between the 'Impact of Shunt Capacitor' case and the 'Limiting Reactive Power Capacity' case? Explain.

Q11. What is the impact of disconnecting the shunt compensation capacitor on the reactive power output of the generator? Explain.

Q12. What is the impact of disconnecting the shunt compensation capacitor on this systems capability? (i.e. the P-V curve limit) Explain.

Q13. If the generator had no reactive power output limit in the 'Impact of Shunt Capacitor' case, what would happen to the systems P-V curve? Sketch qualitative the P-V curves for the following cases:

- Limiting Reactive Power Capacity case.

- Impact of Shunt Capacitor case.

- Impact of Shunt Capacitor case but there is no reactive power limit for the co-generator on Bus 2.

Q14. Explain the differences of the P-V curves for bus 4 and how the system changes that were made brought on those differences.

#### Q-V Curves

Q15. Is there any difference between the two Q-V curves created using the 2 different approaches? Explain.

Q16. Why is the initial `Setpoint Voltage` for the fictitious condenser used in approach 1 set to the bus voltage of the original base case?

Q17. Discuss both the advantages and disadvantages of each approach to obtaining a Q-V curve.