

Experiments 9, 10 & 11 **“Design with Power Flow”** **Project and Formal Report**

You will solve the Design Project # 1 on Page 343 of the Glover/Sarma text. In designing power systems, engineers and planners must guarantee reliability of operation under various conditions, both planned and unplanned. In today's world of deregulation and competition, cost of designing and operating the power system are two major factors. Your job is to design a minimum cost system addition such that the transmission system is adequate under both base case and ‘first contingency’ loading situations.

A number of security constraints have to be met for each design recommendation you make. These are:

- None of the lines or transformers may be loaded higher than 100% of their ratings
- All bus voltage magnitudes stay between 0.95 per unit and 1.06 per unit.
- None of the generator reactive power limits should be exceeded.

Before you begin the design project, it is advised that you make yourself familiar with some of the advanced features of the PowerWorld Simulator, such as the *Contingency Analysis* tool. Also read the design problem statement in the text carefully and ask your lab instructor if you have any questions.

Remember that power networks operate under known AC (sometimes DC as well) circuit principles. Just make sure that you apply known techniques as well as a lot of good old common sense. You may notice that real and reactive powers may flow in opposite directions on the same line. This is a perfectly acceptable condition. You may notice that slack bus active power may become negative. This condition is unacceptable.

You will learn by experimenting, by creating extreme situations, by trial and error and observing cause and effects, and by individual and group discussions.

At the end of the project, you will be required to make a formal report discussing the following:

- initial system problems before any reinforcements were made
- your approach to optimally solving the problems
- your final recommendations, and
- the justification for your final recommendations.

Your report must include copies of your final one-line diagram, and pertinent reports generated by PowerWorld.

It is highly recommended that you add parts to your final report after each week’s activity. However, you only have to submit only one final report at the end of the four week period.