Introduction

This addendum to Laboratory 2, “Introduction to PowerWorld” is intended to introduce the basics of using PowerWorld as a power system simulation tool. It will show you how to open a new simulation (or “case”), insert components and run simulations.

Getting Started

- When you open PowerWorld, you will first need to create a new case. This is done by clicking on the symbol in the top left corner and selecting “New Case”.

- PowerWorld has two main modes: Edit Mode and Run Mode. As you would expect, edit mode is used to create and edit simulations and Run Mode to simulate them.

- In edit mode, you will be using the Draw tab to insert components and create your schematic.
Inserting Components

- To insert components (Generators, T-Lines, XFRMS, Loads, etc) you must first insert a bus. PowerWorld requires all components be connected to a bus.
- Click on the Network Button and select Bus.
- Insert the component where you want it on the screen.
- PowerWorld should open a Bus Options dialog box.

Bus Options

- Refer to the lab manual for a discussion of the various Bus types. In PowerWorld all buses are Load buses by default.
- You must specify only one slack bus for the simulation to run. The figure to the right shows where to specify this option.
- Buses are load buses by default. A bus will become a Voltage Controlled bus based on the components attached to it so you don’t need to worry about specifying whether a bus is load or voltage controlled.
- Additionally, you will need to specify the nominal bus voltage. This is the L-L RMS voltage. This voltage will determine the voltage of the devices connected to the bus.
- After specifying the voltage and whether it is a system slack bus or not, click OK.
Generators

- Now that you have a slack bus, you will need to connect a Generator.
- Click Network->Generator.
- Click on the bus you want the generator connected to. In this case your slack bus (Bus 1).
- The figure to the right shows the Generator Options dialog.
- Since this generator is connected to a the Slack Bus, PowerWorld will be solving for the MW and Mvar output so you do not need to specify any output value. However, you will need to put 0.0.
- Several things to note:

  1. AGC is Automatic Generator Control and should be left checked.
  2. You can leave Enforce MW Limits checked.
  3. AVR is Automatic Voltage Regulation. This allows the generator to control the Var output to maintain the bus voltage to the nominal 1.0p.u. value. For the Slack Generator this must be checked. If you are specifying a fixed output generator (which you are in this lab) this must be unchecked and you must specify the desired Mvar output.
4. Leave everything else default. You can read about what the other options do by clicking on the help button.

5. You can change the visual display and orientation of the component in the Display Information tab.

6. Click OK

Transmission Lines

- To insert a transmission line you need at least two buses, one to connect each end of the transmission line. The buses must have the same nominal voltage.

- Insert another bus in your simulation.

- Select Network->Transmission Lines

- Click once on bus 1, then on bus 2. Don’t move your mouse from bus two and hit ENTER. PowerWorld is finicky about transmission line input. If you move the mouse away from the second bus, when you hit ENTER, the point of the mouse will be the location of the final termination.
Transmission Line Options

- In the transmission lines options box, you can specify the transmission lines parameters. Note that these are in Per Unit parameters. See the lab manual for a discussion of Per Unit values.
- The only parameter you are required to input is the Series Reactance, otherwise PowerWorld won’t run.
- Input the required parameters per the lab manual and click OK.

Loads

- To insert a load, click Network->Load and click on the bus you want to the load connected to.
- Simply enter the MW value and Mvar value in the constant power column and click OK.
- You can read in the help menu the difference between the constant power, constant current, and constant impedance loads.
Running Simulations

- To run a simulation, change to Run Mode, select the Tools tab, and click Play.
- PowerWorld will show the power delivered by the generator for this simulation.
- The green arrows represent power flow.

Adding Fields

- PowerWorld allows you to add information about components such as Voltage, Power, Angle, and a host of other information using fields.
- Enter a Bus Field by selecting Field>Bus Field in the Draw tab (remember to switch to Edit Mode).
- Click on the bus you want to observe.
- Choose the desired type of field, and any other options you may want to use.
- Use this to show bus voltages, real and reactive power on transmission lines, etc as the lab requires.
Transformers

- In order to insert a transformer, you need two buses. A primary bus and a secondary bus. The turns ratio of the transformer (and thus the primary and secondary voltage) is set by the two bus voltages.

- For example, if you want to enter a transformer that has 138kV primary and 11kV secondary, you simply add two buses with those voltages then connect them with a transformer. The bus voltages must be set before you insert the transformer.

- Insert a transformer the same way you would enter a transmission line. Click Network->Transformer and insert between two buses (with the desired voltages already set) and hit enter (remember not to move the mouse).

- Enter the p.u. parameters of the transformer. PowerWorld requires a non-zero series reactance. Note that you can change how the symbol is display in the Display tab of the transformer options.