EE 5308

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PROJECT

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POWER WORLD SIMULATOR

Power World Simulator is an interactive power system simulation package designed to simulate high voltage power system operation on a time frame ranging from several minutes to several days.

The software contains a highly effective power flow analysis package capable of efficiently solving systems consisting of several buses. It is user friendly and a highly interactive power system analysis and visualization platform. It integrates many commonly performed power system tasks like contingency analysis, OPF, PVQV, fault analysis, SCOPF, sensitivity analysis, loss analysis, etc.

Unlike other commercially available power flow packages, however, Simulator allows the user to visualize the system through the use of full-colour animated one line diagrams with full zooming and panning capability. Transmission lines may be switched in or out of service, new transmission or generation may be added, and new transactions may be established, all with a few mouse clicks. Simulator's extensive use of graphics and animation greatly increases the user's understanding of system characteristics, problems, and constraints, as well as of how to remedy them.

Simulator also provides a convenient medium for simulating the evolution of the power system over time. Load, generation, and interchange schedule variations over time may be prescribed, and the resulting changes in power system conditions may be visualized. This functionality may be useful, for example, in illustrating the many issues associated with industry restructuring.

A. Download the power flow data for the IEEE 30 bus system or one can also find them in the handout (the same folder of this project description).The required Information for building up the system, such as system base, bus voltage, and transmission line impedance, can all be found in the data file. Choose the proper connection types for the transformers by yourself and create the system model in Power World Simulator. Note that bus 1 is the swing bus.

PROCEDURE

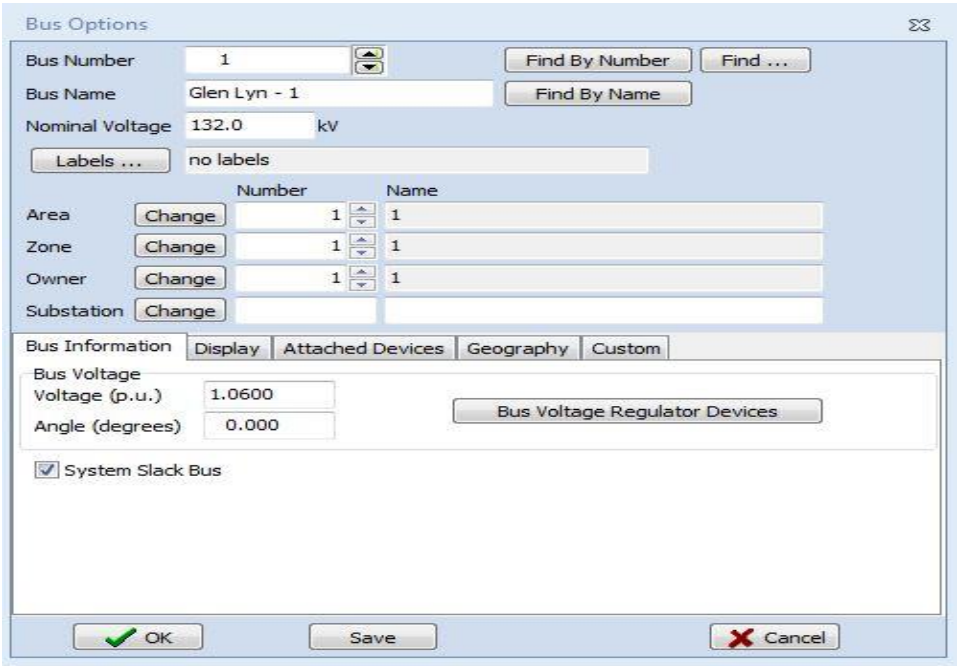
A new case is created by clicking 'Open Case' under File menu. The features of the software are then introduced using this sample case.

1. INPUT OF BUSES

In the given system, there are 30 buses which are connected through various transmission lines. The new case is then put in the edit mode. The buses are then drawn by selecting the option bus from the network tool from the draw menu bar.

STEPS:

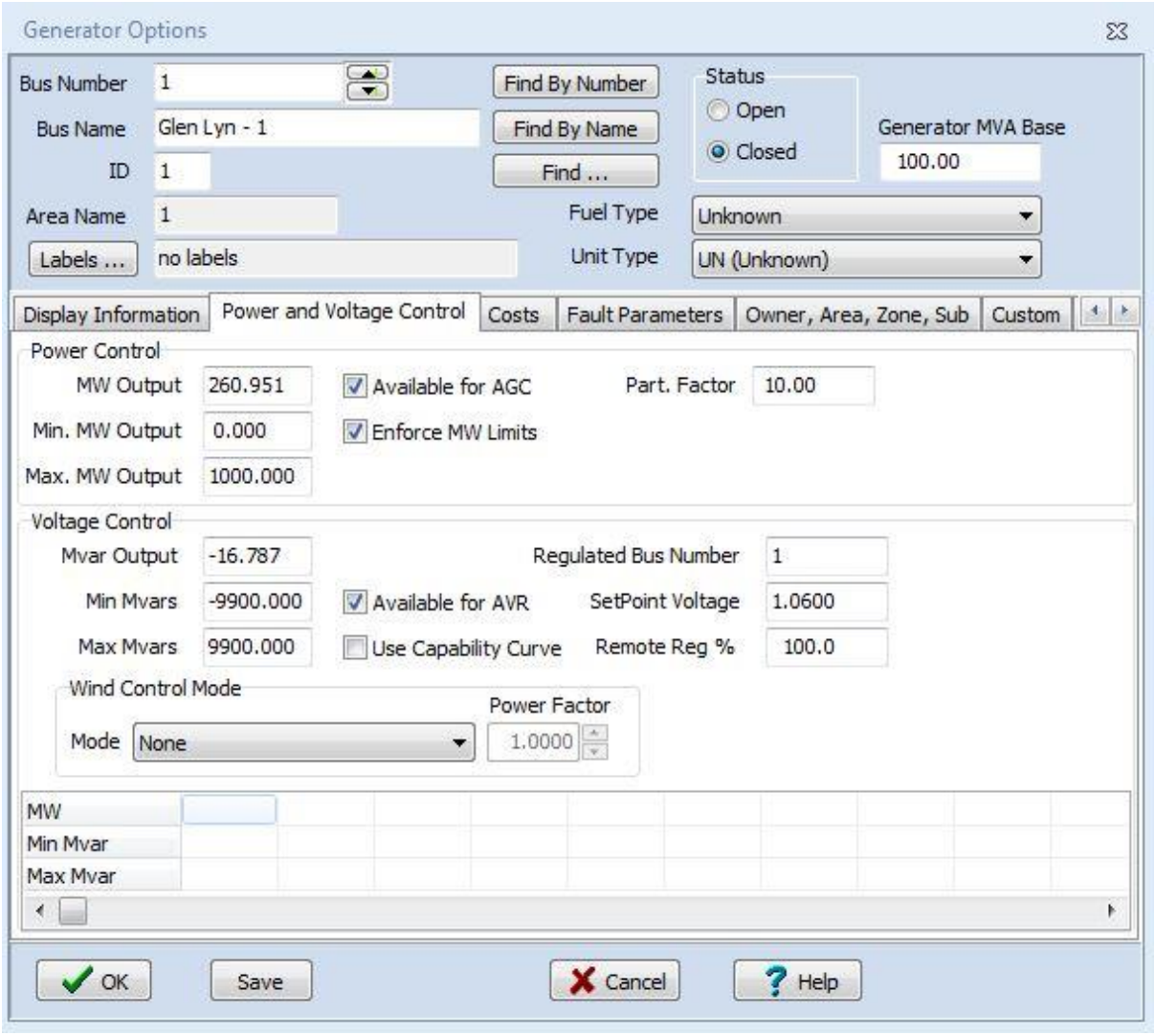
1. Go to Edit Mode.
2. Click Draw menu and select bus.
3. Place the bus on the desired position on the one line diagram.
4. A dialog box named bus options appears on the screen.
5. Enter the necessary information into the dialog box.
6. Check the system slack bus if the bus is chosen as the slack bus.
7. Click OK to finish the input of the particular bus.



2. INPUT OF GENERATORS

STEPS

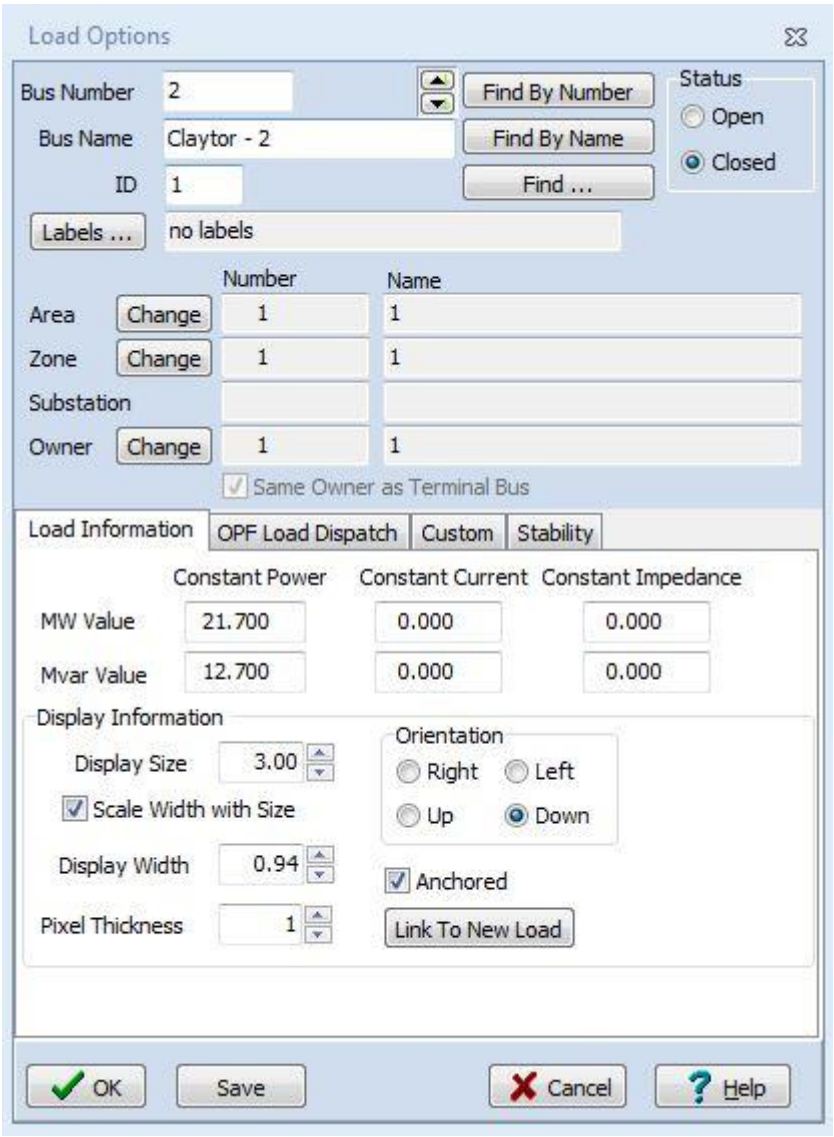
1. Go to Edit Mode.
2. Click Draw menu and select generator.
3. Place the generator on the desired position on the one line diagram.
4. A dialog box named generator options appears on the screen.
5. Enter the necessary information into the dialog box.
6. Select the appropriate machine model, excitor model and governor model.
7. Click OK to finish the input of the particular generator.



3. INPUT OF LOAD

STEPS

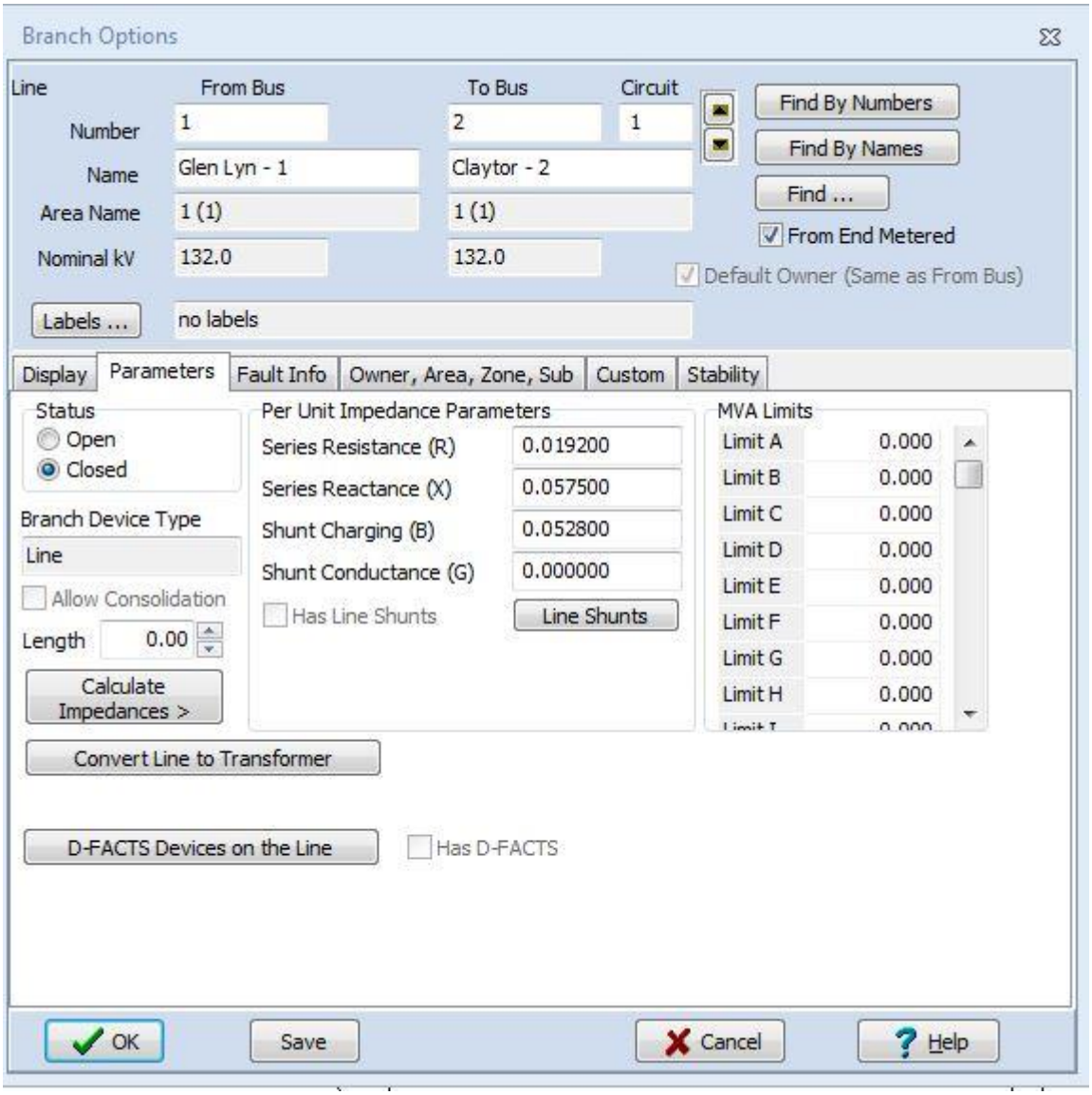
1. Go to Edit Mode.
2. Click Draw menu and select load.
3. Place the load on the desired position on the one line diagram.
4. A dialog box named load options appears on the screen.
5. Enter the necessary information into the dialog box.
6. Click OK to finish the input of the particular load.



4. INPUT OF TRANSMISSION LINES

STEPS

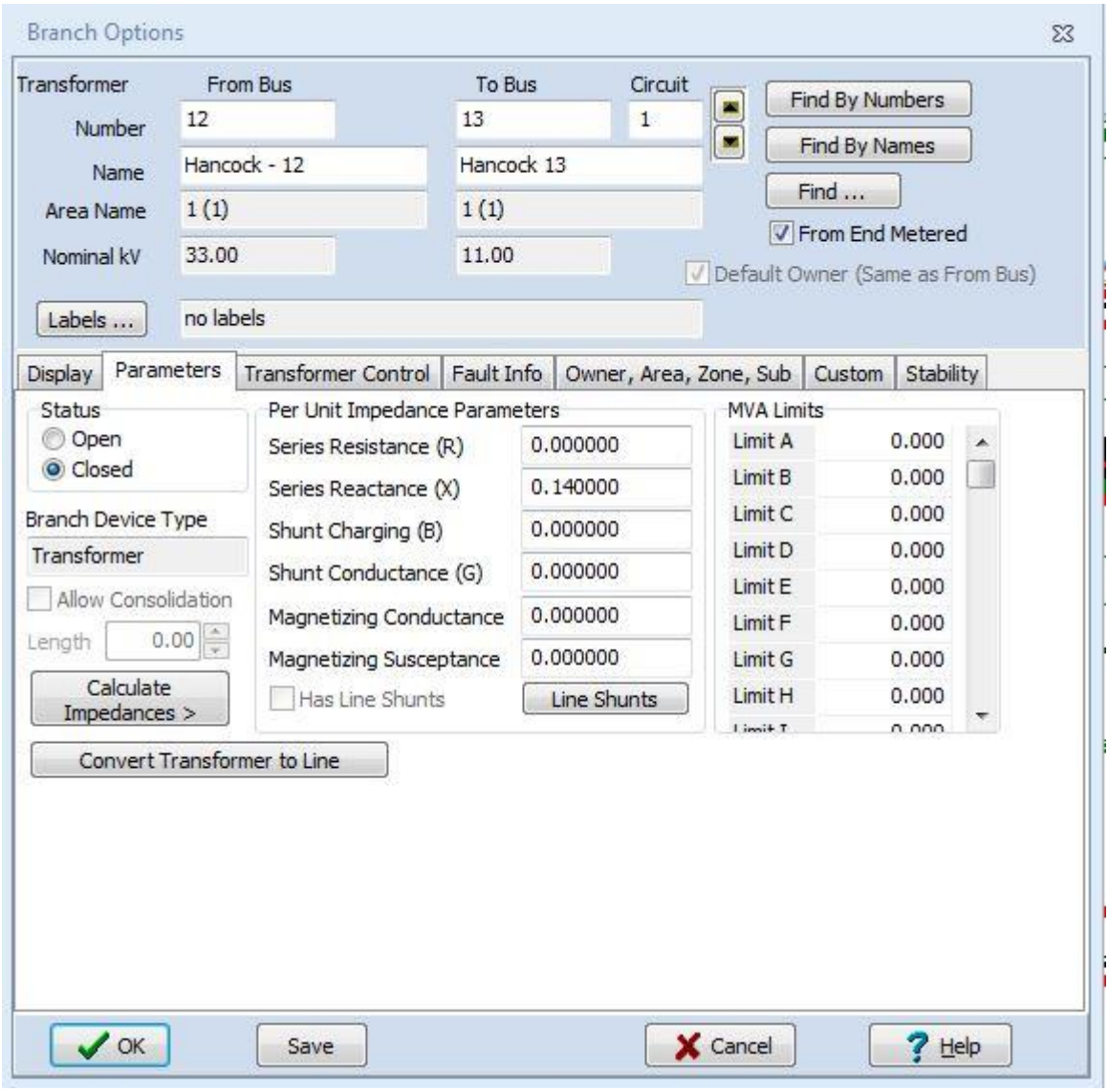
1. Go to Edit Mode.
2. Click Draw menu and select transmission line.
3. Place the transmission line on the desired position on the one line diagram.
4. A dialog box named branch/transmission line options appears on the screen.
5. Enter the necessary information into the dialog box.
6. Click OK to finish the input of the particular transmission line.



5. INPUT OF TRANSFORMERS

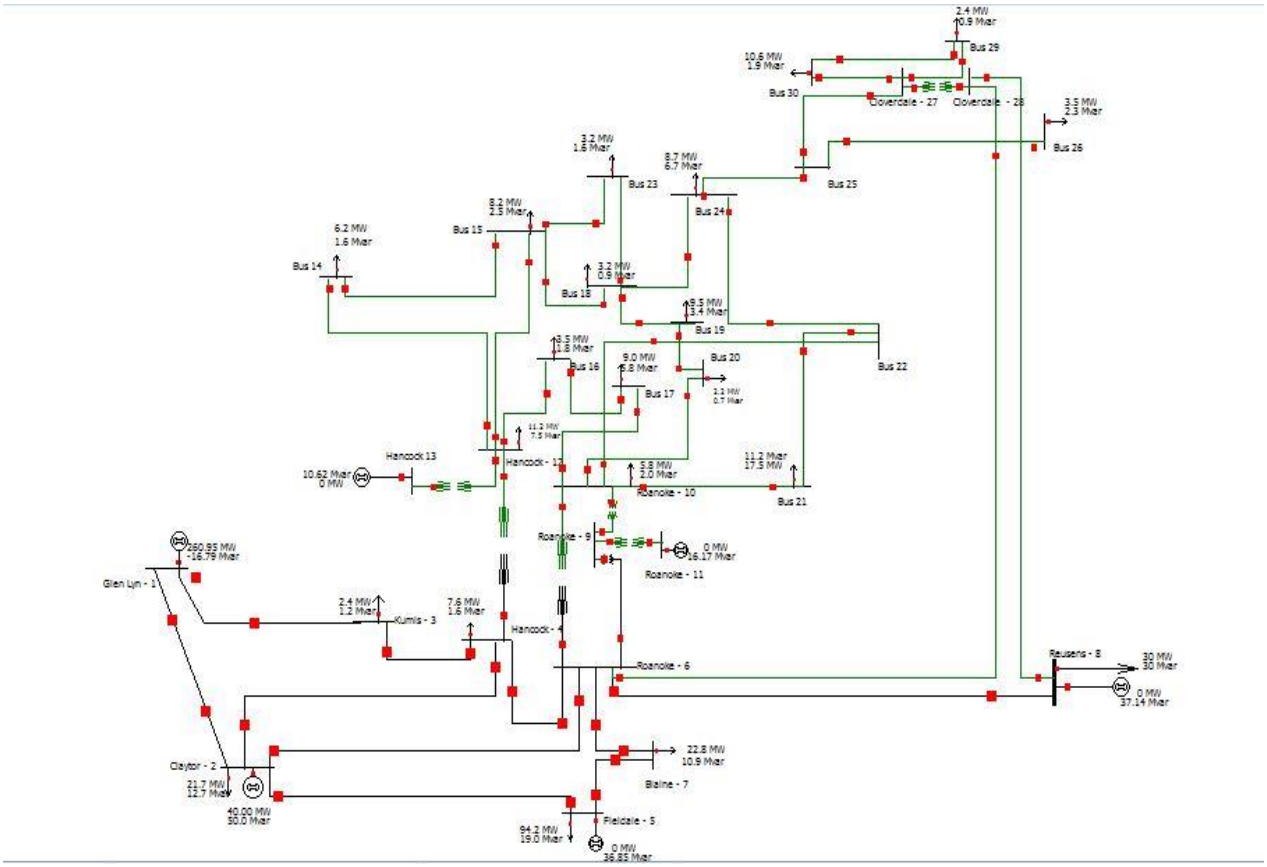
STEPS

1. Go to Edit Mode.
2. Click Draw menu and select transformer.
3. Place the transformer on the desired position on the one line diagram.
4. A dialog box named branch/transformer options appears on the screen.
5. Enter the necessary information into the dialog box.
6. Click OK to finish the input of the particular transformer.



Following all the above mentioned steps and inputting the values from the data sheet, the complete system is built in the Power World Simulator shown below.

The IEEE 30 bus test system shown below is a portion of American Electric Power system built using the Power World Simulator.



The system model is created in Power World based on the requirements and instructions given.

B. Run the power flow program and obtain the bus, line, and transformer input/output data files that you prepared in part **A.** Compare your power flow results with the given results from the IEEE 30 bus system data (part **A**).

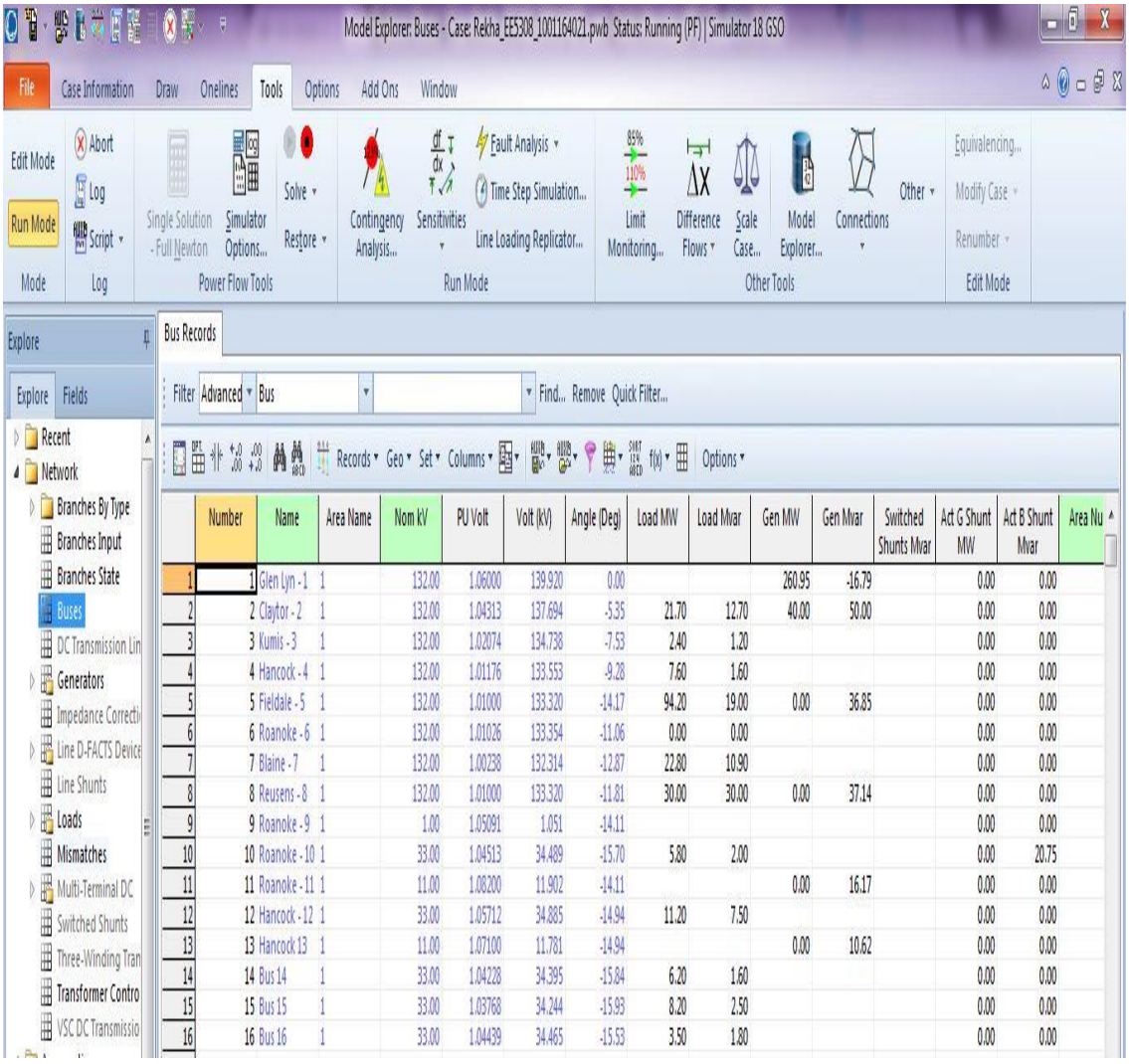
SOLVING THE CASE

STEPS

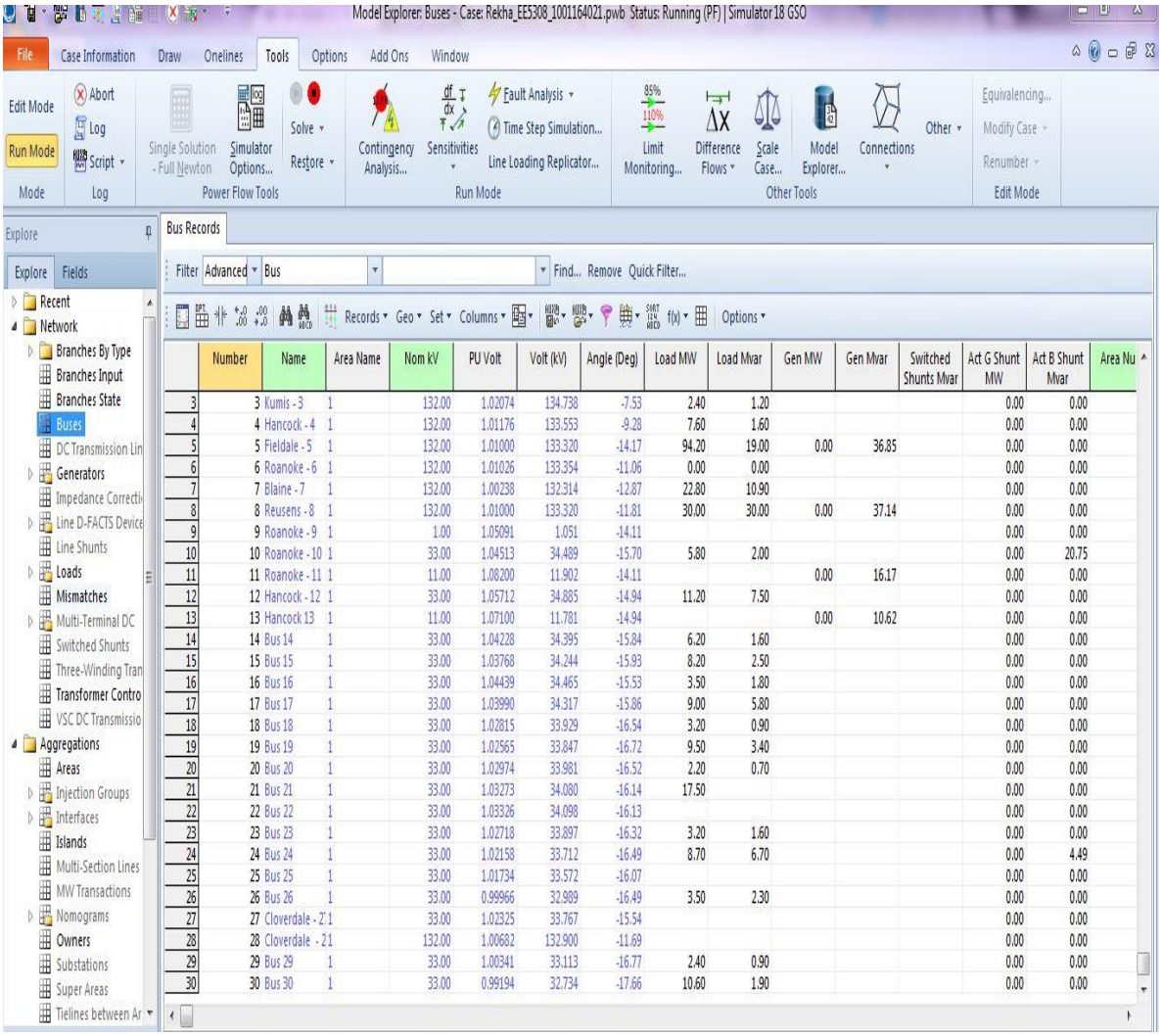
1. Put the case in the Run Mode.
2. Select Play/Solve from the simulation menu.
3. Click on Model Explorer to view the results.
4. Once the results are viewed, Terminate/Stop the play/solve button from the simulation menu.

RESULTS

First 15 Buses:



Till Bus 30:



	Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)	Load MW	Load Mvar	Gen MW	Gen Mvar	Switched Shunts Mvar	Act G Shunt MW	Act B Shunt Mvar	Area Nu
3	3	Kumis - 3	1	132.00	1.02074	134.738	-7.53	2.40	1.20				0.00	0.00	
4	4	Hancock - 4	1	132.00	1.01176	133.553	-9.28	7.60	1.60				0.00	0.00	
5	5	Fieldale - 5	1	132.00	1.01000	133.320	-14.17	94.20	19.00	0.00	36.85		0.00	0.00	
6	6	Roanoke - 6	1	132.00	1.01026	133.354	-11.06	0.00	0.00				0.00	0.00	
7	7	Blaine - 7	1	132.00	1.00238	132.314	-12.87	22.80	10.90				0.00	0.00	
8	8	Reusens - 8	1	132.00	1.01000	133.320	-11.81	30.00	30.00	0.00	37.14		0.00	0.00	
9	9	Roanoke - 9	1	1.00	1.05091	1.051	-14.11						0.00	0.00	
10	10	Roanoke - 10	1	33.00	1.04513	34.489	-15.70	5.80	2.00				0.00	20.75	
11	11	Roanoke - 11	1	11.00	1.08200	11.902	-14.11			0.00	16.17		0.00	0.00	
12	12	Hancock - 12	1	33.00	1.05712	34.885	-14.94	11.20	7.50				0.00	0.00	
13	13	Hancock 13	1	11.00	1.07100	11.781	-14.94			0.00	10.62		0.00	0.00	
14	14	Bus 14	1	33.00	1.04228	34.395	-15.84	6.20	1.60				0.00	0.00	
15	15	Bus 15	1	33.00	1.03768	34.244	-15.93	8.20	2.50				0.00	0.00	
16	16	Bus 16	1	33.00	1.04439	34.465	-15.53	3.50	1.80				0.00	0.00	
17	17	Bus 17	1	33.00	1.03990	34.317	-15.86	9.00	5.80				0.00	0.00	
18	18	Bus 18	1	33.00	1.02815	33.929	-16.54	3.20	0.90				0.00	0.00	
19	19	Bus 19	1	33.00	1.02565	33.847	-16.72	9.50	3.40				0.00	0.00	
20	20	Bus 20	1	33.00	1.02974	33.981	-16.52	2.20	0.70				0.00	0.00	
21	21	Bus 21	1	33.00	1.03273	34.080	-16.14	17.50					0.00	0.00	
22	22	Bus 22	1	33.00	1.03326	34.098	-16.13						0.00	0.00	
23	23	Bus 23	1	33.00	1.02718	33.897	-16.32	3.20	1.60				0.00	0.00	
24	24	Bus 24	1	33.00	1.02158	33.712	-16.49	8.70	6.70				0.00	4.49	
25	25	Bus 25	1	33.00	1.01734	33.572	-16.07						0.00	0.00	
26	26	Bus 26	1	33.00	0.99966	32.989	-16.49	3.50	2.30				0.00	0.00	
27	27	Cloverdale - 2	1	33.00	1.02325	33.767	-15.54						0.00	0.00	
28	28	Cloverdale - 2	1	132.00	1.00682	132.900	-11.69						0.00	0.00	
29	29	Bus 29	1	33.00	1.00341	33.113	-16.77	2.40	0.90				0.00	0.00	
30	30	Bus 30	1	33.00	0.99194	32.734	-17.66	10.60	1.90				0.00	0.00	

COMPARISON OF THE VALUES

Comparing per unit voltages and angles obtained with given results:

	Final(Given)		Result(Observed)	
	voltage	angle	voltage	angle
Glen Lyn – 1	1.060	0.0	1.06000	0.00
Claytor – 2	1.043	-5.48	1.04313	-5.35
Kumis – 3	1.021	-7.96	1.02074	-7.53
Hancock – 4	1.012	-9.62	1.01176	-9.28
Fieldale – 5	1.010	-14.37	1.01000	-14.17
Roanoke – 6	1.010	-11.34	1.01026	-11.06
Blaine – 7	1.002	-13.12	1.00238	-12.87
Reusens – 8	1.010	-12.10	1.01000	-11.81
Roanoke – 9	1.051	-14.38	1.05091	-14.11
Roanoke – 10	1.045	-15.97	1.04513	-15.70
Roanoke – 11	1.082	-14.39	1.08200	-14.11
Hancock – 12	1.057	-15.24	1.05712	-14.94
Hancock 13	1.071	-15.24	1.07100	-14.94
Bus 14	1.042	-16.13	1.04228	-15.84
Bus 15	1.038	-16.22	1.03768	-15.93
Bus 16	1.045	-15.83	1.04439	-15.53
Bus 17	1.040	-16.14	1.03990	-15.86
Bus 18	1.028	-16.82	1.02815	-16.54
Bus 19	1.026	-17.00	1.02565	-16.72
Bus 20	1.030	-16.80	1.02974	-16.52
Bus 21	1.033	-16.42	1.03273	-16.14
Bus 22	1.033	-16.41	1.03326	-16.13
Bus 23	1.027	-16.61	1.02718	-16.32
Bus 24	1.021	-16.78	1.02158	-16.49
Bus 25	1.017	-16.35	1.01734	-16.07
Bus 26	1.000	-16.77	0.99966	-16.49
Cloverdale – 27	1.023	-15.82	1.02325	-15.54
Cloverdale - 28	1.007	-11.97	1.00682	-11.69
Bus 29	1.003	-17.06	1.00341	-16.77
Bus 30	0.992	-17.94	0.99194	-17.66

Comparing Generator real and reactive power:

	Actual		Result	
	Generation MW	Generation Mvar	Generation MW	Generation Mvar
1	260.2	-16.1	260.95	-16.79
2	40	50	40	50
5	0	37	0	36.85
8	0	37.3	0	37.14
11	0	16.2	0	16.17
13	0	10.6	0	10.62

Comparing Load values:

	Actual		Result	
	Load MW	Load Mvar	Load MW	Load Mvar
2	21.70	12.70	21.70	12.70
3	2.40	1.20	2.40	1.20
4	7.60	1.60	7.60	1.60
5	94.20	19.00	94.20	19.00
7	22.80	10.90	22.80	10.90
8	30.00	30.00	30.00	30.00
10	5.80	2.00	5.80	2.00
12	11.20	7.50	11.20	7.50
14	6.20	1.60	6.20	1.60
15	8.20	2.50	8.20	2.50
16	3.50	1.80	3.50	1.80
17	9.00	5.80	9.00	5.80
18	3.20	0.90	3.20	0.90
19	9.50	3.40	9.50	3.40
20	2.20	0.70	2.20	0.70
21	17.50	11.20	17.50	11.20
23	3.20	1.60	3.20	1.60
24	8.70	6.70	8.70	6.70
26	3.50	2.30	3.50	2.30
29	2.40	0.90	2.40	0.90
30	10.60	1.90	10.60	1.90

CONCLUSION

The entire system model is created using the Power World Simulator software. The buses, transmission lines, transformers and loads are drawn as per explained. The values inserted in each of these are in accordance with the data given in the IEEE data sheet. The complete system is drawn in edit mode.

Once the complete system is created, the mode is changed from edit mode to run mode and solve option is given. Once the solve option is given, model explorer option is used to get the required results. These results are then compared with the values present in the IEEE data sheet.

The values for the per unit voltages and angles do not have much difference in them. Almost accurate results are obtained in both of these parameters.

The generator real and reactive power values also do not have much difference in them as seen from the values in the data sheet.

If there are differences in the values, it may be because of the fact that the actual process uses an algorithm using the iterative method compute the load flow for the IEEE 30 bus system and we are using Power world to compute the values.

Hence, from the results seen above, almost nearly accurate results are obtained which matches the values given in the IEEE data sheet.