Power Flow Program User Instruction

1. Data format

The format of data file must follow the IEEE Common Data Format. The data set has two files: one bus csv file and one branch csv file. You can find the sample data in the folder.
Bus data forms a matrix as shown in Table 1. Each row means one bus data. Each column means the bus's certain feature. The format has 20 features. So if we have a n bus power system, the bus matrix is n×20 dimensional.

Table 1 The bus data matrix

1	Bus 1	HV	1	1	3	1.06	0	0	0	232.4	-16.9	0	1.06	0
2	Bus 2	HV	1	1	2	1.045	-4.98	21.7	12.7	40	42.4	0	1.045	50
3	Bus 3	HV	1	1	2	1.01	-12.72	94.2	19	0	23.4	0	1.01	40
4	Bus 4	HV	1	1	0	1.019	-10.33	47.8	-3.9	0	0	0	0	0
5	Bus 5	HV	1	1	0	1.02	-8.78	7.6	1.6	0	0	0	0	0
6	Bus 6	LV	1	1	2	1.07	-14.22	11.2	7.5	0	12.2	0	1.07	24
7	Bus 7	ZV	1	1	0	1.062	-13.37	0	0	0	0	0	0	0
8	Bus 8	TV	1	1	2	1.09	-13.36	0	0	0	17.4	0	1.09	24
9	Bus 9	LV	1	1	0	1.056	-14.94	29.5	16.6	0	0	0	0	0
10	Bus 10	LV	1	1	0	1.051	-15.1	9	5.8	0	0	0	0	0
11	Bus 11	LV	1	1	0	1.057	-14.79	3.5	1.8	0	0	0	0	0
12	Bus 12	LV	1	1	0	1.055	-15.07	6.1	1.6	0	0	0	0	0
13	Bus 13	LV	1	1	0	1.05	-15.16	13.5	5.8	0	0	0	0	0
14	Bus 14	LV	1	1	0	1.036	-16.04	14.9	5	0	0	0	0	0

Branch data forms a matrix as shown in Table 2. Each row means one branch data. Each column means the branch's certain feature. The format has 21 features. So if we have a m branch power system, the branch matrix is m×21 dimensional.

Table 2 The branch data matrix

1	2	1	1	1	0	0.01938	0.05917	0.0528	0	0	0	0	0	0
1	5	1	1	1	0	0.05403	0.22304	0.0492	0	0	0	0	0	0
2	3	1	1	1	0	0.04699	0.19797	0.0438	0	0	0	0	0	0
2	4	1	1	1	0	0.05811	0.17632	0.034	0	0	0	0	0	0
2	5	1	1	1	0	0.05695	0.17388	0.0346	0	0	0	0	0	0
3	4	1	1	1	0	0.06701	0.17103	0.0128	0	0	0	0	0	0
4	5	1	1	1	0	0.01335	0.04211	0	0	0	0	0	0	0
4	7	1	1	1	0	0	0.20912	0	0	0	0	0	0	0.978
4	9	1	1	1	0	0	0.55618	0	0	0	0	0	0	0.969

This program use the transpose matrix of bus matrix and branch matrix.
You can find more about the IEEE format here: http://www2.ee.washington.edu/research/pstca/

2. Start the program

There are two ways to start the program.
1. To run the program through source code, open the project "PowerFlow.sln" in Visual Studio.
2. To run the program through .exe file, find the "PowerFlow.exe" in this directory:
PowerFlow\DataConvertCSV\bin\Debug.
After starting the program, you can see the main window as shown in Figure 1.

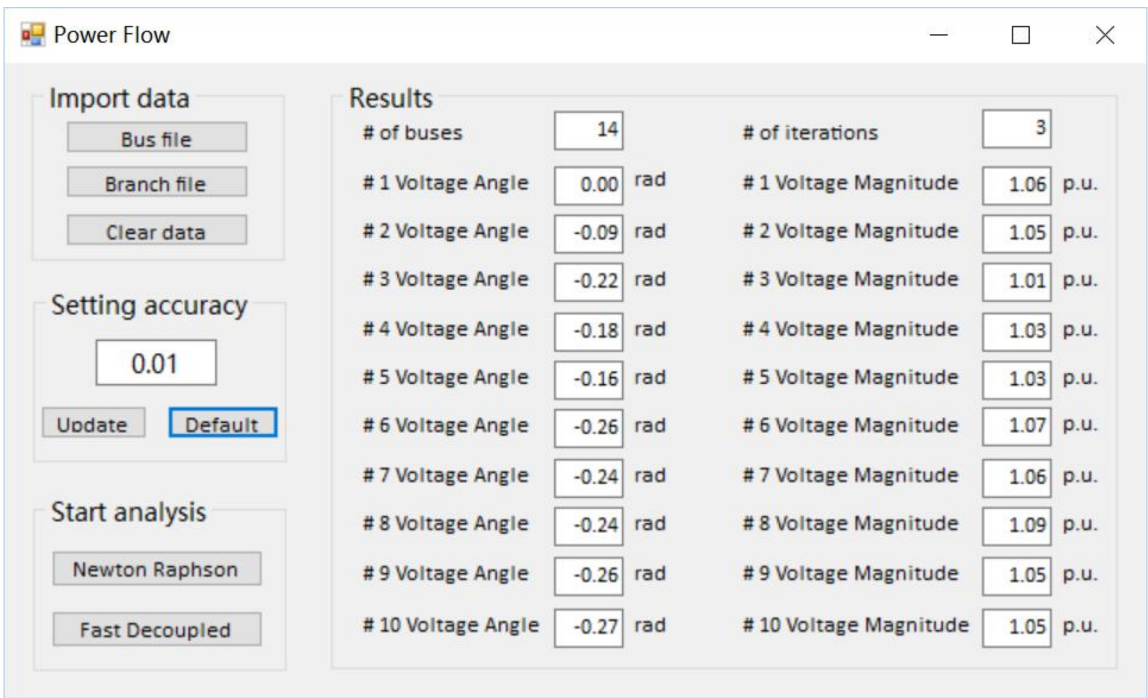

Figure 1 The main window of the power flow program.

2.1 Import data

You can use the three buttons in “Import data” area to import bus data, branch data, and clear the data that you imported.
Note: You need to clear the previous data if you want to use a new set of data.

2.2 Settings

You can set the stopping error in the blank text box in setting area. If the all power mismatch values

are smaller than the stopping error, the iteration stops.
The setting file can be found here: PowerFlow\DataConvertCSV\bin\Debug
The users setting is only valid after clicking the update button.
The default value for stopping error is 0.01. To use default setting, you need to click default button and then click the update button.

3. Start power flow calculation

Start Newton-Raphson power flow calculation when user clicks the "Newton Raphson" button.

4. See the results

After calculation, the results will be displayed in the results area. Here we can only display the first 10 voltage magnitudes and angles.
To see full results of power flow, a file named "results.stg" is saved at: PowerFlow\DataConvertCSV\bin\Debug.

5. Other

1. This program use Newton Raphson to calculate the power flow.
2. LU factorization is used to get the inverse of a matrix. Q matrix is formed using Crout's algorithm.
3. Functions are in CommonFunctions.cs.
4. If you have any questions or advice, please contact Yang Zheng at yang.zheng@wsu.edu.