

Load Flow Comparison Case #3

Comparison of ETAP Load Flow Results against Published Textbook Examples

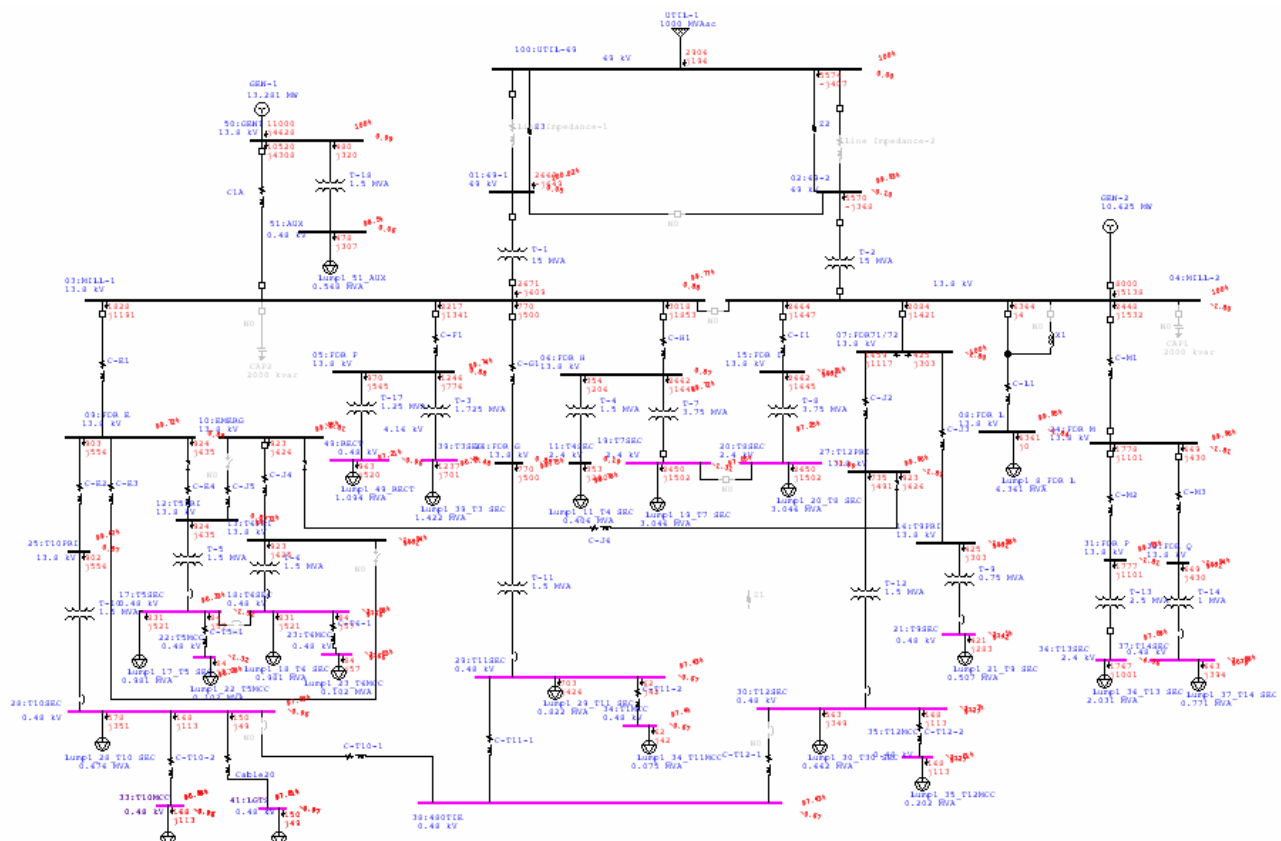
Excerpts from Validation Cases and Comparison Results (TCS-LF-150)

Highlights:

- Comparison between ETAP Load Flow (LF) results against those published in IEEE Std. 399-1997, Brown Book, pages 151-161.
- Comparison of results for the Newton Raphson Method, Accelerated Gauss-Seidel and Fast-Decoupled methods.
- Forty-four bus systems with multiple loads and generators and types of branches.
- Considers line impedance and admittance.
- Comparisons are made against bus voltage magnitude and angle and power flows (MW and Mvar flows).
- The difference in the results is less than 0.001 % for all bus voltages and 0.34% for all power flows (for all three LF methods).

System Description:

This is a forty-four bus system that is composed of lines, cables, transformers, generators, and a utility connection. The line impedance and charging effects are considered. The schedule of generation and loading for each bus was taken as described in Figures 6-5 through 6-7 of the published example. Only the base load flow case was compared in this test case.



Comparison of Results:

The following tables of comparison show the differences between ETAP results and those published in the textbook example. The difference in the results is less than 0.001 % for all bus voltages and less than 0.34 % for all power flows (for all three LF methods).

Bus	Reference		ETAP		% Diff Mag.	% Diff Ang.
	% Mag	Ang(deg)	% Mag	Ang (deg)		
1: 69-1	100.02	0.1	100.02	0.1	0.00	0.00
2: 69-2	99.93	-0.1	99.93	-0.1	0.00	0.00
3: MILL-1	99.77	0.9	99.77	0.9	0.00	0.00
4: MILL-2	100	-1.8	100	-1.8	0.00	0.00
5: FDR F	99.74	0.9	99.74	0.9	0.00	0.00
6: FDR H	99.72	0.9	99.72	0.9	0.00	0.00
7: FDR 71/72	100	-1.8	100	-1.8	0.00	0.00
8: FDR L	99.95	-1.8	99.95	-1.8	0.00	0.00

Table 1: Bus Voltage Comparison for Load Flow method against published results

From Bus	To Bus	Reference		ETAP		% Diff	
		MW	Mvar	MW	Mvar	MW	Mvar
1: 69-1	3: MILL-1	-2.667	0.649	-2.669	0.649	0.07	0.00
3: MILL-1	5: FDR F	2.217	1.341	2.217	1.341	0.00	0.00
3: MILL-1	50: Gen1	-10.503	-4.277	-10.504	-4.277	0.01	0.00
4: MILL-2	2: 69-2	-5.562	0.534	-5.56	0.534	0.04	0.00
4: MILL-2	24: FDR M	2.445	1.530	2.448	1.532	0.12	0.13
5: FDR F	39: T3 SEC	1.246	0.776	1.246	0.776	0.00	0.00
5: FDR F	49: RECT	0.971	0.565	0.97	0.565	0.10	0.00
6: FDR H	11: T4 SEC	0.354	0.206	0.354	0.206	0.00	0.00
6: FDR H	19: T7 SEC	2.662	1.646	2.662	1.646	0.00	0.00
7: FDR 71/72	16: T9 PRI	0.425	0.304	0.425	0.303	0.00	0.33

Table 2: Power Flow Comparison for Load Flow method against published results