

Load Flow Comparison Case # 3

Comparison of ETAP Load Flow Results against a Published Example

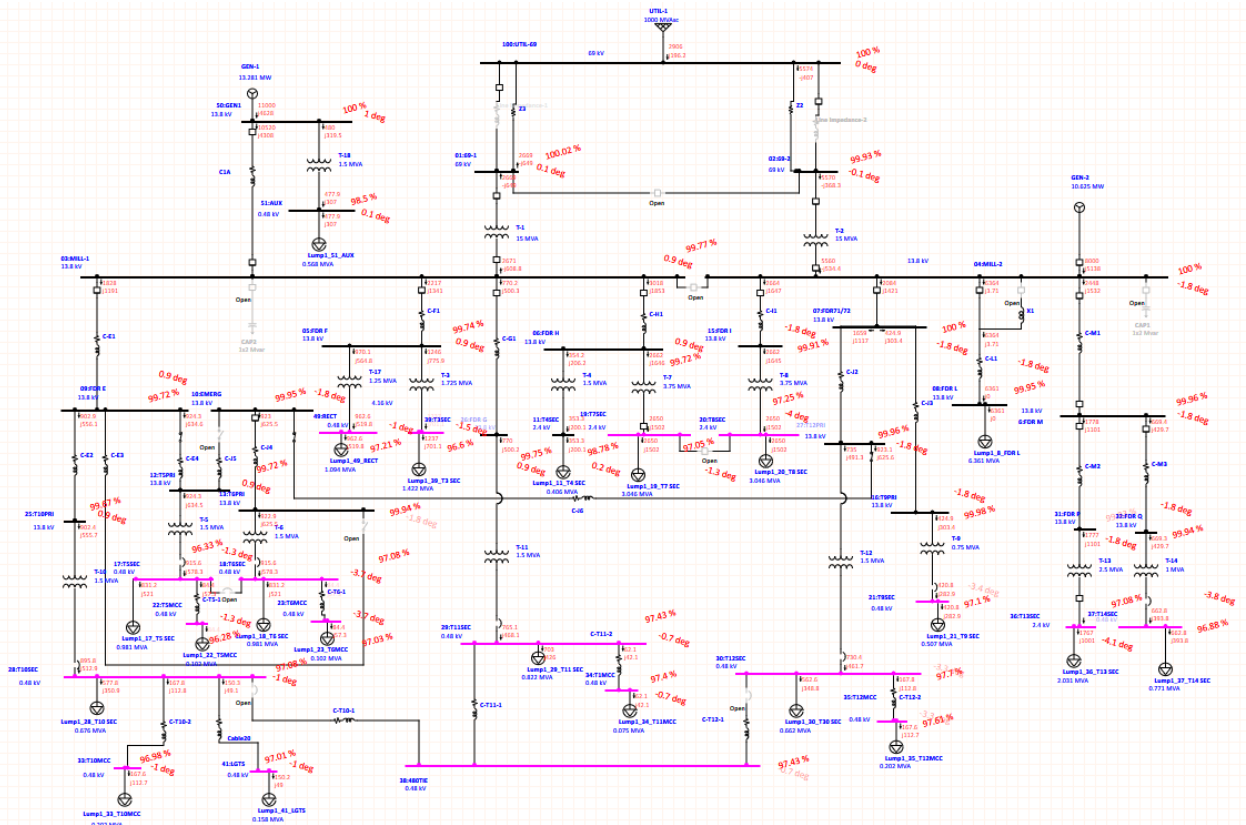
Excerpts from Validation Cases and Comparison Results (TCS-LF-150)

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 (NR), Adaptive Newton Raphson Method (ANR), and Fast-Decoupled methods (FD) are provided.
- 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.



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Comparison of Results

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

BUS	REFERENCE		ETAP								
			ANR			NR			FD		
#	% Mag.	Ang.	%Mag	Ang	% Diff Mag	% Mag.	Ang.	% Diff Mag	% Mag.	Ang.	% Diff Mag
1: 69-1	100.02	0.1	100.02	0.1	0.00	100.02	0.1	0.00	100.02	0.1	0.00
2: 69-2	99.93	-0.1	99.93	-0.1	0.00	99.93	-0.1	0.00	99.93	-0.1	0.00
3: MILL-1	99.77	0.9	99.77	0.9	0.00	99.77	0.9	0.00	99.77	0.9	0.00
4: MILL-2	100	-1.8	100	-1.8	0.00	100	-1.8	0.00	100	-1.8	0.00
5: FDR F	99.74	0.9	99.74	0.9	0.00	99.74	0.9	0.00	99.74	0.9	0.00
6: FDR H	99.72	0.9	99.72	0.9	0.00	99.72	0.9	0.00	99.72	0.9	0.00
7: FDR 71/72	100	-1.8	100	-1.8	0.00	100	-1.8	0.00	100	-1.8	0.00
8: FDR L	99.95	-1.8	99.95	-1.8	0.00	99.95	-1.8	0.00	99.95	-1.8	0.00

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

From	To	REFERENCE		ETAP											
				ANR				NR				FD			
BUS	BUS	MW	Mvar	MW	Mvar	% Diff MW	%Diff Mvar	MW	Mvar	% Diff MW	%Diff Mvar	MW	Mvar	% Diff MW	%Diff Mvar
1: 69-1	3: MILL-1	-2.67	0.65	-2.67	0.65	0.00	0.00	-2.67	0.65	0.00	0.00	-2.67	0.65	0.00	0.00
3: MILL-1	5: FDR F	2.22	1.34	2.22	1.34	0.00	0.00	2.22	1.34	0.00	0.00	2.22	1.34	0.00	0.00
3: MILL-1	50: Gen1	-10.50	-4.28	-10.50	-4.28	0.00	0.00	-10.50	-4.28	0.00	0.00	-10.50	-4.28	0.00	0.00
4: MILL-2	2: 69-2	-5.56	0.53	-5.56	0.53	0.00	0.00	-5.56	0.53	0.00	0.00	-5.56	0.53	0.00	0.00
4: MILL-2	24: FDR M	2.45	1.53	2.45	1.53	0.00	0.00	2.45	1.53	0.00	0.00	2.45	1.53	0.00	0.00
5: FDR F	39: T3 SEC	1.25	0.78	1.25	0.78	0.00	0.00	1.25	0.78	0.00	0.00	1.25	0.78	0.00	0.00
5: FDR F	49: RECT	0.97	0.57	0.97	0.57	0.00	0.00	0.97	0.57	0.00	0.00	0.97	0.57	0.00	0.00
6: FDR H	11: T4 SEC	0.35	0.21	0.35	0.21	0.00	0.00	0.35	0.21	0.00	0.00	0.35	0.21	0.00	0.00
6: FDR H	19: T7 SEC	2.66	1.65	2.66	1.65	0.00	0.00	2.66	1.65	0.00	0.00	2.66	1.65	0.00	0.00
7: FDR71/72	16: T9 PRI	0.43	0.30	0.43	0.30	0.00	0.00	0.43	0.30	0.00	0.00	0.43	0.30	0.00	0.00

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

Reference

1. "IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis (Brown Book)," in *IEEE Std 399-1997*, vol., no., pp.1-488, 31 Aug. 1998.
2. ETAP Load Flow V&V Documents, Case Number TCS-LF-150

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