KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE-463 Project

Semester (131)

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Part I: Load-Flow Studies

The line-data and bus-data of the IEEE 14-bus system are given below on a 100 MVA base. The minimum and maximum limits of voltage magnitude and phase angle are considered to be 0.95p.u. to 1.05p.u. and -45^o to +45^o respectively.

Line Data of IEEE 14-Bus System

Line number	From bus	To bus	Line impedance ($p.u.$)		Half line charging susceptance ($p.u.$)	MVA rating
			Resistance	Reactance		
1	1	2	0.01938	0.05917	0.02640	120
2	1	5	0.05403	0.22304	0.02190	65
3	2	3	0.04699	0.19797	0.01870	36
4	2	4	0.05811	0.17632	0.02460	65
5	2	5	0.05695	0.17388	0.01700	50
6	3	4	0.06701	0.17103	0.01730	65
7	4	5	0.01335	0.04211	0.00640	45
8	4	7	0	0.20912	0	55
9	4	9	0	0.55618	0	32
10	5	6	0	0.25202	0	45
11	6	11	0.09498	0.1989	0	18
12	6	12	0.12291	0.25581	0	32
13	6	13	0.06615	0.13027	0	32
14	7	8	0	0.17615	0	32
15	7	9	0	0.11001	0	32
16	9	10	0.03181	0.0845	0	32
17	9	14	0.12711	0.27038	0	32
18	10	11	0.08205	0.19207	0	12
19	12	13	0.22092	0.19988	0	12
20	13	14	0.17093	0.34802	0	12

Transformer Tap Setting Data of IEEE 14-Bus System

From bus	To bus	Tap setting value ($p.u.$)
4	7	0.978
4	9	0.969
5	6	0.932

Bus Data of IEEE 14-Bus System

Bus number	Bus voltage		Generation		Load		Reactive power limits	
	Magnitude $(p.u.)$	Phase angle (degree)	Real power (MW)	Reactive power $(MVAR)$	Real power (MW)	Reactive power $(MVAR)$	$Q_{\min}$ $(MVAR)$	$Q_{\max}$ $(MVAR.)$
1	1.060	0	114.17	-16.9	0	0	0	10
2	1.045	0	40.00	0	21.7	12.7	-42.0	50.0
3	1.010	0	0	0	94.2	19.1	23.4	40.0
4	1	0	0	0	47.8	-3.9	–	–
5	1	0	0	0	7.6	1.6	–	–
6	1	0	0	0	11.2	7.5	–	–
7	1	0	0	0	0	0	–	–
8	1	0	0	0	0	0	–	–
9	1	0	0	0	29.5	16.6	–	–
10	1	0	0	0	9.0	5.8	–	–
11	1	0	0	0	3.5	1.8	–	–
12	1	0	0	0	6.1	1.6	–	–
13	1	0	0	0	13.8	5.8	–	–
14	1	0	0	0	14.9	5.0	–	–

Shunt Capacitor Data of IEEE 14-Bus System

Bus Number	**Suseptance (p.u.)**
9	0.19 + 0.Your two-digit serial number

1. Use the Power World Simulation Package to simulate the above IEEE 14-bus power system indicating the following:

- The single line diagram of the system including the circuit breaker at both ends of every line.
- The voltage (p.u.), generation (MW and MVAR), and load (MW and MVAR) for each bus.
- The line-flows (MW and MVAR) at both ends of every line.
- The line-flow pie chart on every line.

2. Perform the following tasks:

- Run your **own case** for a simulation time of 2 hours (7200 seconds) and simulation speedup of 60 seconds.
- Use the load variation graph to simulate a varying load increase from 100% (using the base case) to 150% during the simulation time (**This must be automated increase in the load**).
- Show the animated flows on the single-line diagram.
- Enforce the line overloads to check the line limits.
- Detect and record any system's abnormality during the simulation time (e.g., bus voltages outside 5% range of the nominal values, overloaded lines, …etc.).

3. Introduce a solution for the problems detected earlier to ensure a normal operation of the system during the simulation time (the two-hours).

4. Write a formal typed-report showing the following items:

- The single-line diagram of the original case.
- Statement on the problems faced during the simulation time.
- The single-line diagram of the modified case (showing all modifications made to resolve the problems of the original case).
- Statements on the suggested solutions with clear explanation and justification for each solution.

Submission Format:

Submit a hard-copy as well as a softcopy (on a cd). Label the softcopy with your student ID for all files in the following format:

- S200xxxxx0-o.pwd for the original file with extension pwd.
- S200xxxxx0-o.pwp for the original file with extension pwp.
- S200xxxxx0-m.pwd for the modified file with extension pwd.
- S200xxxxx0-m.pwp for the modified file with extension pwp.
- S200xxxxx0.doc for the report file with extension doc.

Control Options:

You may use one of the following control options:

- Increase the number of circuit of lines (maximum one circuit).
- Add a new line (maximum two circuits).
- Add a new Generator to one of the existing busses (one generator of 100MW and 40MVAR).
- Add Capacitor banks (maximum at two locations; each with 40MVAR).
- Use Transformer taps (maximum +/- 25% of the nominal value).

Part II: Short-Circuit Studies

Consider the IEEE 14-bus system given in Part I of this project. Assume that each generator has a subtransient reactance of 15% on the 100MVA base. Conduct short circuit analysis before and after modifying your system for the following:

- Calculate the subtransient fault current seen by each circuit breaker due to a solid three-phase fault occur at all bus locations.
- Calculate the subtransient fault current seen by each circuit breaker due to a three-phase fault through an impedance of (0.1+ 0.your two digit serial number) occur at all bus locations.
- Find out the proper capacity (in MVA) needed of each circuit breaker in these busses.

Due date: December 9th 2013

Good Luck in your project