

EE531 Homework 1 Due Friday 9/5 Hardcopy or Electronic

System in Figure 3.13 Page 79 of text (attached on the next page for convenience); You may work in groups. Please use mathcad, matlab or similar tool and save your stuff. We will use this model several more times.

Assume each generator has a subtransient impedance of $j 0.1$ pu on system base. Load is ignored.

Develop the incidence matrix

Calculate the admittance matrix Y using $C^T y_{\text{prim}} C$; check using rules—develop an implementation that stores the 'From' and 'To' vectors in the system data table and then uses this information in a pair of loops to construct Y using the rules

For a three phase fault at bus 5, find fault current, all voltages, and all branch currents

Now assume lines 5-2 and 5-6 are mutually coupled¹. The primitive impedance matrix for this line pair is

$$z = \begin{bmatrix} 0.071 + j0.32 & j.03 \\ j.03 & 0.025 + j0.15 \end{bmatrix} \text{ pu}$$

Calculate the admittance matrix Y using $C^T y_{\text{prim}} C$; check using rules

For a three phase fault at bus 5, find fault current, all voltages, and all branch currents; compare with the case with no coupling and comment.

¹ *This is a positive sequence network and normally we would not see significant coupling; so this problem is more for practice.*

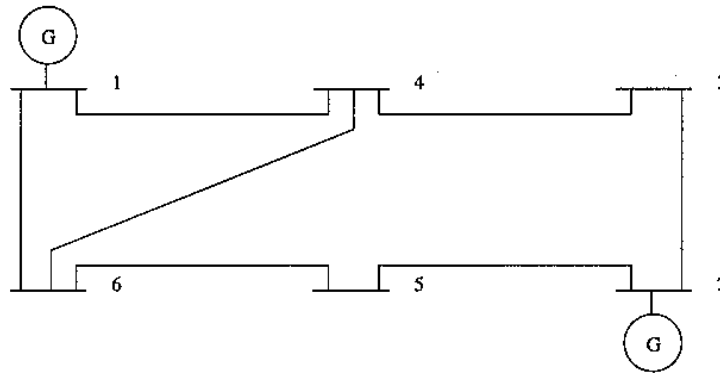


FIGURE 3.13
Ward-Hale 6 bus system

The data for the system shown in Figure 3.13 are given below:

No.	Type	$ V $	θ	P_{gen}	Q_{gen}	P_{load}	Q_{load}
1	0	1.05	0	0	0	0.25	0.1
2	1	1.05	0	0.5	0	0.15	0.05
3	2	1.00	0	0	0	0.275	0.11
4	2	1.00	0	0	0	0	0
5	2	1.00	0	0	0	0.15	0.09
6	2	1.00	0	0	0	0.25	0.15

No.	To	From	R	X	B
1	1	4	0.020	0.185	0.009
2	1	6	0.031	0.259	0.010
3	2	3	0.006	0.025	0.000
4	2	5	0.071	0.320	0.015
5	4	6	0.024	0.204	0.010
6	3	4	0.075	0.067	0.000
7	5	6	0.025	0.150	0.017