

Problem Set #6 Power-flow solutions, Gauss-Seidel Method, and Newton-Raphson Method

6-1 (Keyhani Lecture)

Using Gauss elimination and back substitution solve:

$$\begin{bmatrix} 10 & 3 & 0 \\ 4 & 12 & 2 \\ 5 & 2 & 14 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

6-2 (Keyhani Lecture)

Use Newton-Raphson to find one solution to the polynomial equation $f(x)=y$, where $y=0$ and $f(x)=3x^3+4x^2+5x+6$. Start with $x(0)=1.0$ and continue until:

$$\left| \frac{x(i) - x(i-1)}{x(i-1)} \right| < \varepsilon$$

is satisfied, where $\varepsilon=0.001$.

6-3 (Keyhani Lecture)

Use Newton-Raphson to find a solution to:

$$\begin{bmatrix} e^{x_1 x_2} \\ \cos(x_1 + x_2) \end{bmatrix} = \begin{bmatrix} 1.2 \\ 0.5 \end{bmatrix}$$

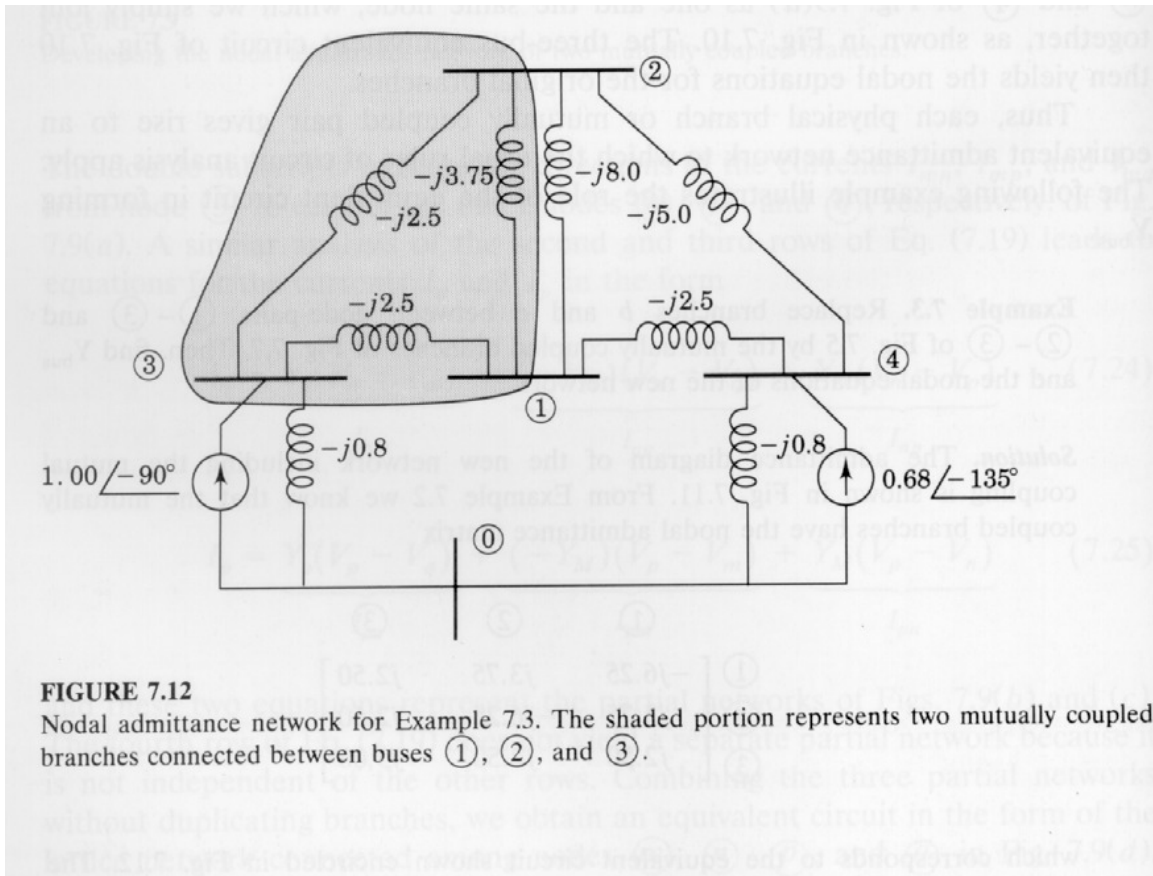
where x_1 and x_2 are in radians.

a) Start with $x_1(0)=1.0$ and $x_2(0)=0.5$ and continue until Equation (6.1) is satisfied with $\varepsilon=0.005$.

b) Show that Newton-Raphson diverges for the example if $x_1(0)=1.0$ and $x_2(0)=2.0$.

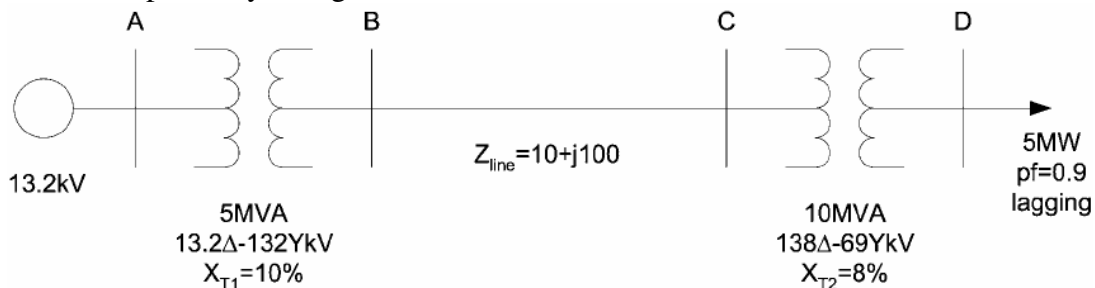
6-4

Find Z_{BUS} for the four bus circuit of Figure 7.12 which has per unit admittances as marked.



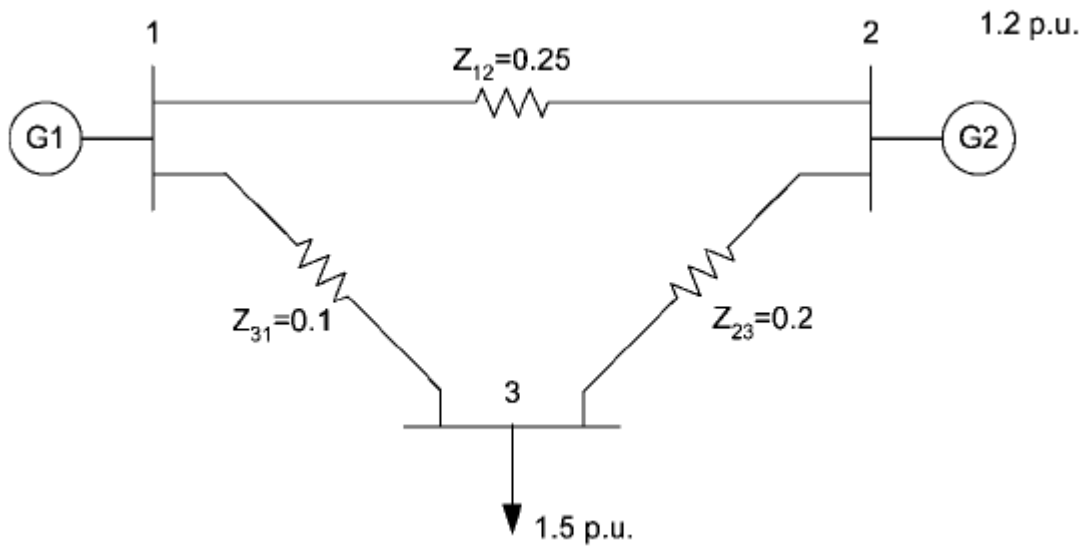
6-5 (Keyhani Lecture)

Consider the power system given below:



- 1) Assume the generator voltage is set at 10% above its rated value, and the load connected to bus D is equal to 5 MW at a pf of 0.9 lagging. Compute the per-unit model for the above system.
- 2) Compute the load voltage (Bus D).
- 3) Compute the active and reactive power supplied by Bus A.
- 4) Compute the active and reactive losses.

6-6 (Keyhani Lecture)



Given:

Bus 1 is slack bus: $V=1 \angle 0^\circ$

Scheduled power at Bus 2 is 1.2 p.u.

Scheduled load at Bus 3 is 1.5 p.u.

Compute:

- 1) YBUS model
- 2) Bus voltages using Gauss-Seidel Method
- 3) Power mismatch at Bus 2 and 3
- 4) Power supplied by the swing bus
- 5) Power loss of transmission lines