SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT – III
PROBLEM - NEWTON RAPHSON METHOD

PROBLEM

1.Perform an iteration of Newton-Raphson load flow method and determine the power flow solution for the given system take base MVA as 100.(15)

Line	Bus		$R_{p.u}$	$X_{p.u}$	Half line charging admittance $Y_{p/2}$(p.u)
	From	To			
1	1	1	0.0839	0.5183	0.0636

Bus	P_L	Q_L
1	90	20
2	30	10

Step 1:

Form Y_{bus} matrix

$$Y_{bus} = \begin{bmatrix} 1.842\langle -1.405 & 1.904\langle 1.7314 \\ 1.904\langle 1.7314 & 1.842\langle -1.405 \end{bmatrix}$$

Step 2: Assume the initial value, $\delta = 0$ V=1.0

$$[\![X]\!] = \begin{bmatrix} \delta_2 \\ V_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 1.0 \end{bmatrix}$$

Step 3: calculate P_2^{cal} Q_2^{cal} and ΔP_2 and ΔQ_2

$$P_2^{cal} = |V|_2|V|_1|Y|_{12}\cos(\theta_{12}+\delta_2-\delta_1) + |V|_2|V|_2|Y|_{22}\cos(\theta_{22}+\delta_2-\delta_2) = -0.015$$

p.u

$$Q_2^{cal} = -|V|_2|V|_1|Y|_{12}\sin(\theta_{12}+\delta_2-\delta_1) - |V|_2|V|_2|Y|_{22}\sin(\theta_{22}+\delta_2-\delta_2) = -0.157$$

p.u

$$\Delta P_2 = P_{2(spec)} - P_2^{cal} = -0.285$$

$$\Delta Q_2 = Q_{2(spec)} - Q_2^{cal} = 0.057$$

Step 4: Form Jacobian matrix

$$\begin{bmatrix} \frac{\partial P_2}{\Delta\delta_2} & |V|_2\frac{\partial P_2}{\partial V_2} \\ \frac{\partial Q_2}{\partial\delta_2} & |V|_2\frac{\partial P_2}{\partial V_2} \end{bmatrix}\begin{bmatrix} \Delta\delta_2 \\ \frac{\Delta|V|_2}{|V_2|} \end{bmatrix} = \begin{bmatrix} \Delta P_2 \\ \Delta Q_2 \end{bmatrix}$$

PROBLEM

$$\frac{\partial P_2}{\Delta \delta_2} = |V|_2 |V|_1 |Y|_{12} \sin(\theta_{12} + \delta_2 - \delta_1) = 1.973$$

$$|V|_2 \frac{\partial P_2}{\partial V_2} = |V|_2 |V|_1 |Y|_{12} \cos(\theta_{12} + \delta_1 - \delta_2) + 2 |V|_2 |V|_2 |Y|_{22} \cos(\theta_{22}) = 0.289$$

$$\frac{\partial Q_2}{\partial \delta_2} = |V|_2 |V|_1 |Y|_{12} \cos(\theta_{12} + \delta_1 - \delta_2) = -0.3197$$

$$|V|_2 \frac{\partial P_2}{\partial V_2} = |V|_2 |V|_1 |Y|_{12} \sin(\theta_{12} + \delta_1 - \delta_2) + 2 |V|_2 |V|_2 |Y|_{22} \sin(\theta_{22}) = 1.66$$

Step 5: Compute Δx,

$$\begin{bmatrix} \Delta \delta_2 \\ \frac{\Delta |V|_2}{|V_2|} \end{bmatrix} = \begin{bmatrix} \frac{\partial P_2}{\Delta \delta_2} & |V|_2 \frac{\partial P_2}{\partial V_2} \\ \frac{\partial Q_2}{\partial \delta_2} & |V|_2 \frac{\partial P_2}{\partial V_2} \end{bmatrix}^{-1} \begin{bmatrix} \Delta P_2 \\ \Delta Q_2 \end{bmatrix}$$

$$= \begin{bmatrix} 1.973 & 0.289 \\ -0.3196 & 1.66 \end{bmatrix}^{-1} \begin{bmatrix} -0.285 \\ 0.057 \end{bmatrix}$$

$$= \begin{bmatrix} -0.145 \\ 0.064 \end{bmatrix}$$

$$\delta_2^1 = \delta_2^0 + \Delta \delta_2 = -0.145 \text{rad}$$

$$V_2^1 = V_2 + \frac{\Delta |V|_2}{|V_2|} = 1.0064 \text{p.u}$$

Advantages & Disadvantages of N- R Method

- This method is faster, more reliable and results are more accurate.
- Requires less number of iterations.
- The number of iterations depends on size of the system.
- Suitable for large system

- The programming logic is more
- Memory requirement is more
- Number of calculations per iteration is high


thank
you