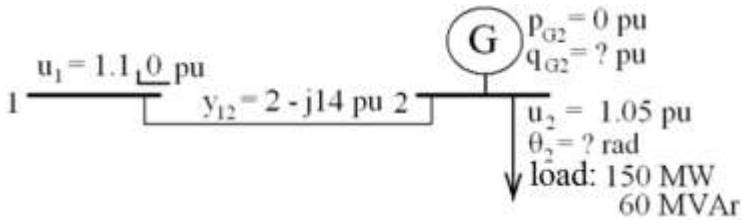
Example: Calculate voltage phase angle in bus no. 2 and generated reactive power in PU bus by using the N-R method after first 2 iterations. Base power S_V equals 100 MVA, round the results on 5 decimal places, start with zero value of voltage phase angle in bus no. 2.



Calculation:

$$\underline{A} = \begin{bmatrix} 2-j14 & -2+j14 \\ -2+j14 & 2-j14 \end{bmatrix} pu \rightarrow G_{21} = -2\ pu, B_{21} = 14\ pu, G_{22} = 2\ pu, B_{22} = -14\ pu.$$

$$U_1 = 1.1\ pu, \theta_1 = 0\,°, U_2 = 1.05\ pu, P_{L2} = -1.5\ pu, Q_{L2} = -0.6\ pu, P_{G2} = 0.0\ pu.$$

The network consists of only 1 PU bus, therefore the Jacobian will have the size of 1x1 and there will be only 1 equation:

$$\Delta P_2 = H_{22}\Delta\theta_2 \rightarrow \Delta\theta_2 = \Delta P_2 / H_{22} = -0.086271\ rad\ (1.it.) \rightarrow \theta_2^{(p+1)} = \theta_2^{(p)} + \Delta\theta_2$$

The mismatch active power is:

$$\Delta P_2 = (P_{G2} + P_{L2}) - U_2[U_1(G_{21}\cos\theta_2 + B_{21}\sin\theta_2) + G_{22}U_2] = -1.395\ pu\ (1.it.)$$

Calculation of H_{22}:

$$H_{22} = -Q_2 - B_{22}U_2^2 = 16.17\ pu\ (1.it.) \qquad Q_{G2} = Q_2 - Q_{L2} = -0.135\ pu\ (1.it.)$$

The value of Q_2 is unknown, it is necessary to calculate it as follows:

$$Q_2 = U_2[U_1(G_{21}\sin\theta_2 - B_{21}\cos\theta_2) - B_{22}U_2] = -0.735\ pu\ (1.it.)$$

The results from first two iterations are shown in the table below:

it	U_1	θ_1	U_2	θ_2	ΔP_2	Q_2	Q_{G2}	H_{22}	$\Delta\theta_2$
0	1.1	0	1.05	0	---	---	---	---	---
1	1.1	0	1.05	**-4°56'**	-1.395	-0.735	**-0.135**	16.17	-4°56'
2	1.1	0	1.05	**-4°58'**	-0.0129932	-0.476445	**0.123555**	15.91145	-0°2'