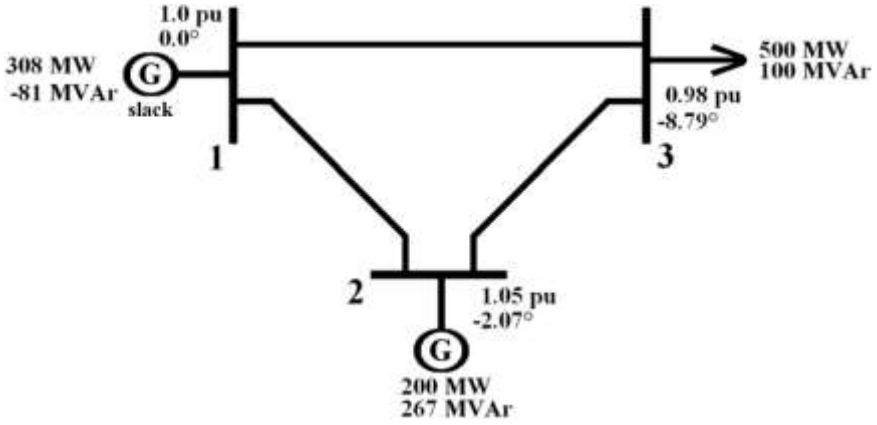
Example: On picture below, there is a 3-bus network with already solved voltage/power conditions in all buses.



The final Jacobi matrix is also given in per units with base power S_V = 100 MVA for achieved load flow solution, i.e. in the last iteration of N-R method

$$\begin{bmatrix} \Delta P_2 \\ \Delta P_3 \\ \Delta Q_3 \end{bmatrix} = \begin{bmatrix} 43.42 & -21.56 & 0.4237 \\ -21.07 & 35.99 & -1.5913 \\ 0.414 & -8.44 & 34.75 \end{bmatrix} \begin{bmatrix} \Delta\theta_2 \\ \Delta\theta_3 \\ \Delta U_3 \end{bmatrix}$$ (Set of 3 equations)

Note: Generator in bus no. 2 has infinite reactive power limits.

Task: Calculate

a) the value of reactive power compensation in bus no. 3 to hold the voltage in bus no. 3 on value of 1.0 pu?
b) corresponding value of shunt susceptance of used capacitor for a).
c) voltage in bus no. 3 if the load in this bus decreases by 50 %.
d) voltage in bus no. 3 if the active power generation in bus no. 2 decreases to 170 MW.

Hint: It is always the solution of the set of 3 equations with 3 unknown variables. For a), c) and d), the 3 change values are put on the left or right side of the set of 3 equations and remaining 3 unknowns in the set of 3 equations will be solved by hand or by computer (MATLAB). This example shows the advantage of using Jacobi matrix for sensitivity analysis.

[Solution: a) $Q_C \approx 0.686\ pu$ b) $B_C \approx 0.686\ pu$ c) $U_3 = 1.0181\ pu, \theta_3 = -3.06°$ d) $U_3 = 0.9787\ pu,$ $\theta_3 = -9.12°$]