EXPERIMENT NO 5

OBJECTIVE

To develop a software program to obtain real and reactive power flows, bus voltage magnitude and angles by using N-R method.

SOFTWARE USED

MATLAB

THEORY

Load flow study in power system parlance is the steady state solution of the power system network. The main information obtained from this study comprises the magnitudes and phase angles of load bus voltages, reactive powers at generator buses, real and reactive power flows on transmission lines, other variables being specified. This information is essential for the continuous monitoring of current state of the system and for analyzing the effectiveness of alternative plans for future system expansion to meet increased load demanded.

Newton – Raphson method is an iterative method that approximates the set of non linear simultaneous equations to a set of linear simultaneous equations using Taylor's series expansion and the terms are limited to first approximation. The rate of convergence is fast as compared to the FDLF program and also it is suitable for large size system. So we go for N-R method.

The non-linear equations governing the power system network are,

$$I_p = \sum_{P=q} Y_{pq} V_p \quad \text{for all p}$$

Where I_p is the current injected into bus p.

The complex power in p^{th} bus is given by,

$$S_p = V_p I_p^*$$

$$= V_p[\sum_{q=1}^{n} Y_{pq} V_q]^*$$

In polar co-ordinates, the power on p^{th} bus is given as,

$$S_p = P_p + jQ_p = \sum_{q=1}^{n} |V_p| |V_q| e^{j\delta pq} |Y_{pq}| e^{j\theta pq}$$

Separating the real and imaginary parts we gets,

$$P_p = \sum_{q=1}^{n} |V_p| |V_q| |Y_{pq}| \cos(\delta_p + \theta_{pq} - \delta_q)$$

$$Q_p = = \sum_{q=1}^{n} |V_p| |V_q| |Y_{pq}| \sin(\delta_p + \theta_{pq} - \delta_q)$$

PROBLEM STATEMENT

Consider a three phase system of fig.1 .each of the three lines has a series impedance of 0.02+j0.08 pu and a total shunt admittance of j0.02pu. The specified quantities at the bus are tabulated below ,

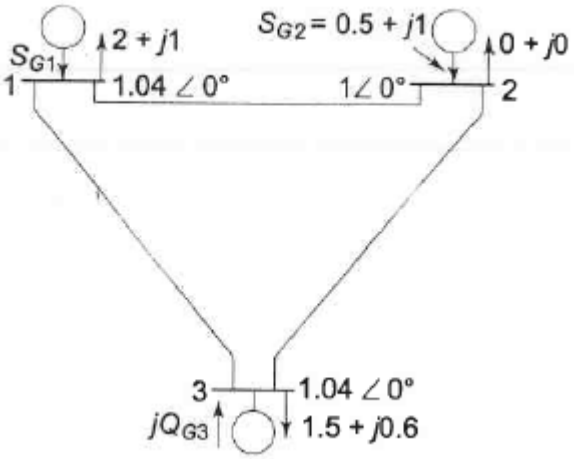

Fig.1 Three phase system

Bus	Real load demand	Reactive load demand	Real power generation	Reactive power generation	Voltage specification
1	2.0	1.0	Unspecified	Unspecified	V_1= 1.04+j0 (Slack bus)
2	0.0	0.0	0.5	1.0	Unspecified (PQ bus)
3	1.5	0.6	0.0	Q_{G3}=?	$\|V_3\|$=1.04 (PV bus)

Controllable reactive power source is available at bus 3 with the constraint

$$0 \leq Q_{G3} \leq 1.5\ pu$$

Find the load flow solution using the NR method. Use a tolerance of 0.01 for power mismatch.

CONCLUSION

The MATLAB code for the above problem is run and executed.

REFERENCES

[1]. Stevenson Jr, W. D. (1982). *Elements of Power System Analysis*, (4th), Mc-Graw Hill Higher Education.

[2]. HadiSaadat, "*Power System Analysis*", Milwaukee School of Engineering, McGraw Hill, 1999.

[3]. Kothari D. P., Nagrath I. J., *"Modern Power System Analysis"*,Mc-Graw Hill Higher Education.