Final Year Project

Report On

“Power System Analysis”

Team Members:-

- Hafiz Muhammad Rehan Afzal (091420366)
- Mohsinlatif (091420357)
- EhtishamAsghar (091420376)

Advisors:-

Sir TabraizAlvi& Sir AsifHussain

Department of Electrical Engineering

School of Engineering

University of Management and Technology

Power System Analysis

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Hafiz Muhammad Rehan Afzal (091420366)

Mohsinlatif (091420357)

EhtishamAsghar (091420376)

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Abstract

Electric power system is large interconnected network of generators, transmission and distribution facilities and electrical loads. Such a huge system is prone to many kinds of disturbances which may lead to undesirable effects on the network, such as blackouts or loss of synchronism in generators. Transient stability analysis examines the dynamic behavior of a power system for as much as several seconds following a power disturbance.

Computational complexity of transient stability analysis have kept them from being run in real-time to support decision making at the time of a disturbance and prevent cascading failures. Parallel processing is a promising technology for the speed up of the dynamic simulation required in transient stability. This project presents the transient stability analysis performed on the graphics multiprocessors as an emerging general purpose parallel platform.

The analysis involves solution of extremely large systems of differential and algebraic equations. Various integration techniques are available to transform the differential equations to non-differential, nonlinear system of equations. However, the core of the resulting nonlinear equations from any integration schemes is the solution of a large sparse linear system.

Dedication

First of all we are very thankful to ALLAH ALMIGHTY who has given us enough courage to complete this task. Then it is dedicated to our kind teachers**Sir TabraizAlvi& Sir AsifHussainand Our Parents** who enlightened our minds with Knowledge, tried hard to encourage us for hard work so that we could have a bright future in terms of being good human and turn out to be competent Engineers with powers to take challenging problems.

Acknowledgements

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We would also like to thank **Sir Asif**of UMT-Lahore for all his valuable assistance in the research work.

Words are inadequate in offering our thanks to all others for their encouragement and cooperation in carrying out research work.

Finally, yet importantly, we would like to express our heartfelt thanks to ALLAH ALMIGHTY, our beloved parents for their blessings, my friends/classmates for their help and wishes for the successful completion of this research.

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PROJECT OBJECTIVE

To do analysis of power system via power flow analysis, short circuit analysis and transient stability analysis using PSS(Power System Simulator) and with Matlab code (Newton Raphson Method).

Deliverable:-

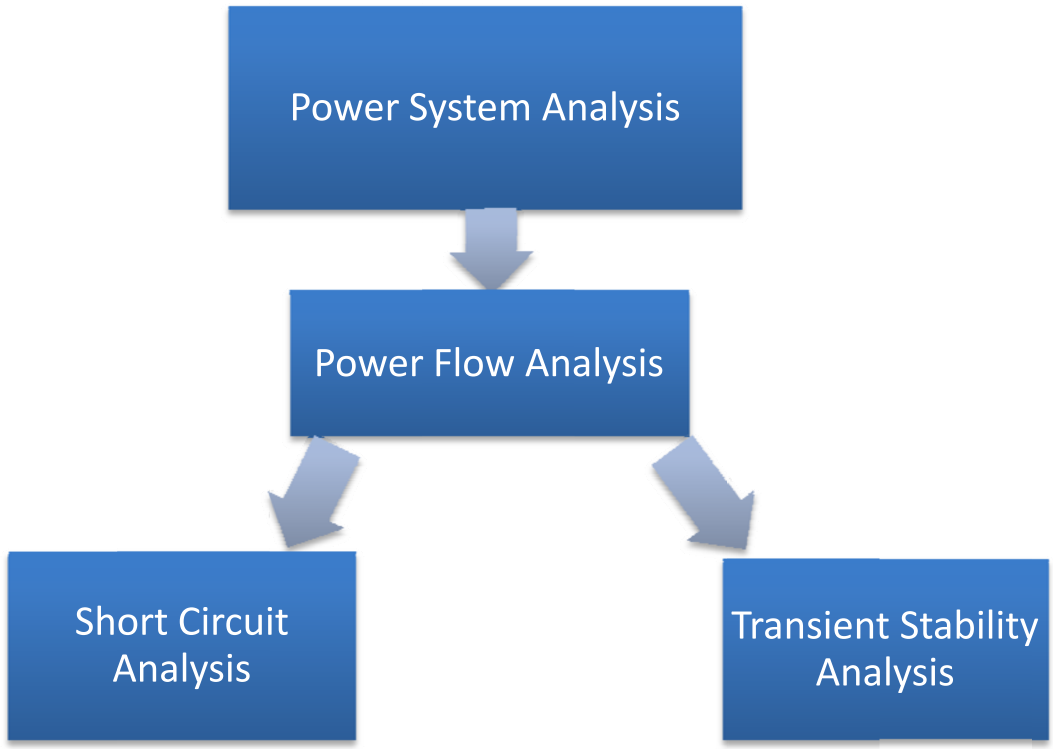
Software calculations and simulations:

- ✓ Power Flow Analysis
- ✓ Short Circuit Analysis
- ✓ Transient Stability Analysis

MATLAB coding of power flow analysis:

- ✓ Newton Raphson Method

BLOCK DIAGRAM



Power Flow Analysis

Objectives

- To study the performance of the transmission lines, transformers and generators.
- Load-flow studies are often used to identify the need for additional generation.
- Necessary for planning, economic scheduling, and control of an existing system as well as planning its future expansion
- Bus voltage profiles
- Real and reactive power flow
- Transformer tap settings

Background

Load flow analysis is probably the most important of all network calculations since it concerns the network performance in its normal operating conditions. It is performed to investigate the magnitude and phase angle of the voltage at each bus and the real and reactive power flows in the system components.

Load flow analysis has a great importance in future expansion planning, in stability studies and in determining the best economical operation for existing systems. Also load flow results are very valuable for setting the proper protection devices to insure the security of the system. In order to perform a load flow study, full data must be provided about the studied system, such as connection diagram, parameters of transformers and lines, rated values of each equipment, and the assumed values of real and reactive power for each load.

Bus Classification

Each bus in the system has four variables: voltage magnitude, voltage angle, real power and reactive power. During the operation of the power system, each bus has two known variables and two unknowns. Generally, the bus must be classified as one of the following bus types:

1. Slack or Swing Bus

This bus is considered as the reference bus. It must be connected to a generator of high rating relative to the other generators. During the operation, the voltage of this bus is always specified and remains constant in magnitude and angle. In addition to the generation assigned to it according to economic operation, this bus is responsible for supplying the losses of the system.

2. Generator or Voltage Controlled Bus

During the operation the voltage magnitude at this the bus is kept constant. Also, the active power supplied is kept constant at the value that satisfies the economic operation of the system. Most probably, this bus is connected to a generator where the voltage is controlled using the excitation and the power is controlled using the prime mover control (as you have studied in the last experiment). Sometimes, this bus is connected to a VAR device where the voltage can be controlled by varying the value of the injected VAR to the bus.

5 Load Bus

This bus is not connected to a generator so that neither its voltage nor its real power can be controlled. On the other hand, the load connected to this bus will change the active and reactive power at the bus in a random manner. To solve the load flow problem we have to assume the complex power value (real and reactive) at this bus.

Techniques of Solution

Because of the nonlinearity and the difficulty involved in the analytical expressions for the above power flow equations, numerical iterative techniques must be used such as:

1. Gauss-Seidel method (G-S).
2. Newton-Raphson method (N-R).

We used Newton-Raphson method, for coding as well as simulation.