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FAULT RESPONSE AND LOAD FLOW ANALYSIS USING MATLAB

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ABSTRACT: *In order to find the steady state operating condition load analysis is carried out in power system. Load flow analysis is the backbone of power system analysis and design. Load flow analysis plays a vital role in designing of new networks or for extending the previous ones..Here in this paper analysis has been carried out using MATLAB. Here we use newton raphson and decoupled load flow method and determine the fault at various buses.The variation of real and reactive power loss over buses also been determined.*

Keywords: Compensation, Jacobian, Distribution system, Decoupled load

1. INTRODUCTION

Load flow analysis is a very important step in the planning of organised networks or modification of existing ones.For example addition of new generator sites,in order to meet the increasing load demand and finding of new transmission sites. In a three phase ac power system both the reactive and active power flows from the generating station to the load using different networks buses and branches. Such a flow of active and reactive power is called power flow or load flow. Load flow analysis is the backbone of power system and designing. It is also necessary for, economic scheduling,planning and exchange of power between different utilities. Load flow analysis is for some other analysis such as transient stability, power flow and other various contingency studies flow analysis is required. The principal information of load flow analysis is to measure the magnitude and phase angle of voltage at each bus and also to find the reactive power and active power flowing in each of transmission lines. Load flow analysis is an involves numerical analysis and its application to a power system. In this analysis, we use various iterative techniques because there is no known mathematical method for solving the problem. It results in a number of nonlinear set of equations which are called as load flow equations.For this analysis there are various methods of numerical calculations which involvest many steps depending on the size of system. This process is difficult and takes very large time if performed by hand. So developing a toolbox for load flow analysis surely will help the analysis become easier.Load flow analysis software can help users to calculate the load flow problem. They are necessary for planning, operation, economic scheduling and exchange of power between different utilities. The basic information involves in analysis of power flow is to estimate the magnitude and phase angle of voltage at each bus and estimating the flow of real and reactive power through various transmission lines.

The load flow solution provides the magnitude of voltages at various nodes and phase angles and hence the power at all the buses and it also measures power flows using connected power channels.

It is helpful in determining the best location as well as optimal capacity of substation and new power lines. It also finds the voltage of the buses. The voltage level at the certain buses must be maintained within limits so that System

transmission loss minimizes. The line flows can be known.

For Power flow analysis software used author is MATLAB software.MATLAB as a high-performance language for technical computation integration, and programming in various aspects. And so it becomes a standard instructional tool for advanced courses in various subjects like science, mathematics or engineering.MATLAB is viewed by many users not only as a high-performance language but it also provides suitable environment for building graphical user interfaces (GUI). Data visualization and GUI design in MATLAB are based on a System which involves handle graphics and in which the objects organized in a Graphics Object Hierarchy can be manipulated by various high and low level commands.

2. LITERATURE REVIEW

In the literature, we studied various efficient and reliable load flow solution techniques, such as; Gauss-Seidel, Newton-Raphson and Fast Decoupled Load Flow.In 1967, C. S. Cheng and D. Shirmohammadi developed the classical Newton based power flow solution method.[1] Later it is modified by B. Stott and O. Alsac made the fast decoupled Newton method. The algorithm made by him remains unchanged for different applications. Even though this method worked well for transmission systems, but its convergence performance poor for most distribution systems in which high value of R/X ratio is obtained which deteriorates the dominance power of the Jacobian matrix. For this reason, various other types of methods have been presented. Those methods consist of backward/forward sweeps on a ladder system.

The formulation of the algorithm for those methods were different from the Newton's power flow method, which made those methods hard to be extended to other applications in which the Newton method seemed more appropriate.[2]

D.Das, H.S.Nagi and D.P.Kothari, presented a Newton like method for solving ill-conditioned power systems. Their method showed voltage convergence but this voltage is not suitable for power flow calculations. It is very important to analyse the flow of power via transmission line. Thus to control and improve the performance of ac power systems, we need the various different types compensators Now-a-days the Flexible AC Transmission Systems (FACTS) is very popular and important tool in power systems. After introducing the FACTS technology, power flow becomes very much versatile, flexible and controllable[3].

G.B. Jasmon, L.H.C. Lee proposed a methodology for solving the radial load flow for analyzing the optimal capacitor sizing problem. In this method, various non-linear equations are written in terms of the branch power flows and bus voltages. The number of equations was subsequently reduced by using terminal conditions associated with the feeder and then Newton- Raphson method is applied to this reduced set. The computational efficiency is then improved by using jacobian..He had proposed decoupled algorithms.[4] In fact these distribution power flow algorithms proposed by Chiang were similar to that of previous one. Dommel, H.W. and Tinney had presented a direct method for solving radial and meshed distribution networks branches, one entering and two leaving signals. Jasmon and Lee had proposed a new load-flow method that provides the radial distribution networks. solution Rapid fast and variable load variations considerably effect the capacity of power system. The dynamic load necessary brings important effect to the frequency of power system.So theDynamic load modeling is modelled for analysing power system reliability problem. The parameters that mainly affect the frequency of system are to be determined. However, the accurate modelling of

load continues to be a typical task because of various factors, including: multiple of diverse load components .Ownership and location of load devices are not properly accessible to the electricity. Lack of precise information on the composition of the load . Uncertainties according to the features of many load components, particularly for large variation in frequency .They have used various fundamental equations which represents real power, reactive power and voltage magnitude derived [5].

They solved distribution network using these equations by reducing the whole network into a single equivalent. S. K. and D.S.Suresh,had proposed a load-flow technique for solving distribution networks by calculating the total flowed power fed through any node using power convergence with the help of coding at various nodes for large system which increases complexity of computation. This method works on the scheme of sequential branch and node numbering scheme. They had calculated voltage of each receiving end node using forward sweep. They had taken the initial guess of zero initial power loss to solve radial distribution networks. It can solve the simple algebraic recursive expression of voltage magnitude and all the data can be easily stored in vector form, thus saving an enormous amount of computer memory.[6]

P Dias, L. G. And M.E.El-Hawary resented a new and efficient method for solving both radial and meshed networks with more than one feeding node. The method first converted the multiple-source mesh network into an equivalent single-source radial type network by setting dummy nodes. Then the traditional ladder network method could be applied for the equivalent radial system. Unlike other method effect of shunt and load admittances are incorporated in this method because of which it can be employed to solve special transmission networks. This method has excellent convergence for radial network. iterative and at every step loads are simulated by impedances. Therefore it is necessary to solve a network made up only of impedances; for radial systems, all the voltages and currents are expressed as linear functions of a single unknown current.. Advantages of this method are: its possibility to take into account of any dependency of the loads on the voltage, very reduced computational requirements and high precision of results.[7]

In this thesis, a new method of load-flow technique for solving radial distribution networks by sequential numbering scheme has been proposed. The aim of this thesis is to reduce data preparation and propose a method to identify the nodes beyond each branch with less computation. Since the distribution system is radial in nature having high R/X ratio, the load flow methods become complicated. The aim of this thesis work is to reduce the data preparation using the sequential numbering scheme and the radial feature of distribution networks. The proposed method not only reduces the data preparation but also increases the efficiency of the load flow.

3. EXPERIMENTAL APPROACH:

Newton-Raphson method is commonly used method widely used for solving simultaneous nonlinear algebraic equations. A Newton-Raphson method involves approximation procedure which is based on estimation of one-dimensional equation obtained by expansion of series.. The Newton-Raphson method basically usesa bus admittance matrix in either first or second order Taylor series and it provides a best solution for the reliability and the rapid convergence .

$f(x)=c$ (1)

If x(0) is an initial estimate of the solution, and Δ x(0) is a small deviation from the correct solution, we must have

$f(x(0)+ \Delta x(0))=c$ (2)

Expanding the left-hand side of the above equation in Taylor's series about x(0) yields

f(x(0)) + (df/dx)(0) Δ x(0) +1/2! (d2f/dx2) (0) (Δ x(0))2+...= c (3)

Assuming the error Δ x(0) is very small, the higher-order terms can be neglected, which result in

Δ c(0)≈ (df/dx)(0) Δ x(0)

where

Δ c(0)=c - f(x(0))

Adding Δ x(0)to the initial provides second approximation

x(1)= x(0) + Δ c(0)/ (df/dx)(0) (5)

Successive use of this procedure yields the Newton-Raphson algorithm

Δ c(k)=c - f(x(k)) (6)

Δ x(k)= Δ c(k)/ (df/dx)(k (7)

x(k+1)= x(k)+ Δ x(k) (8)

(7) can be rearranged as

Δ c(k)= j(k) Δ x(k) where j(k) = (df/dx)(k) (9)

4. RESULTS AND DISCUSSION:

The simulated result of fault and load analysis over buses in power system using newton raphson and decoupled method are discussed below:

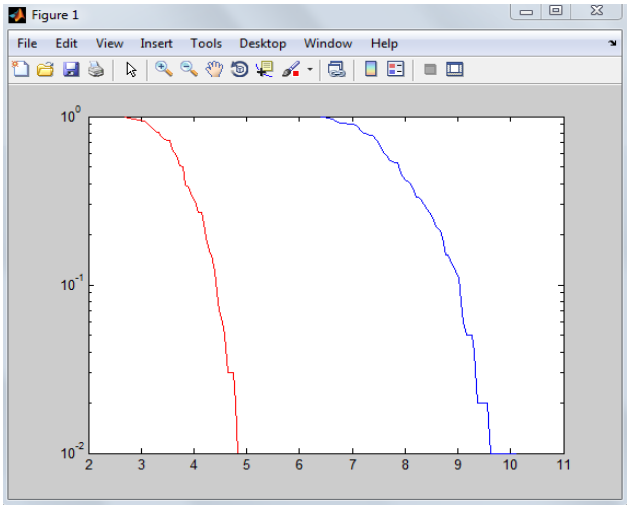

Fig 11. represents newton raphson and decoupled load flow profile

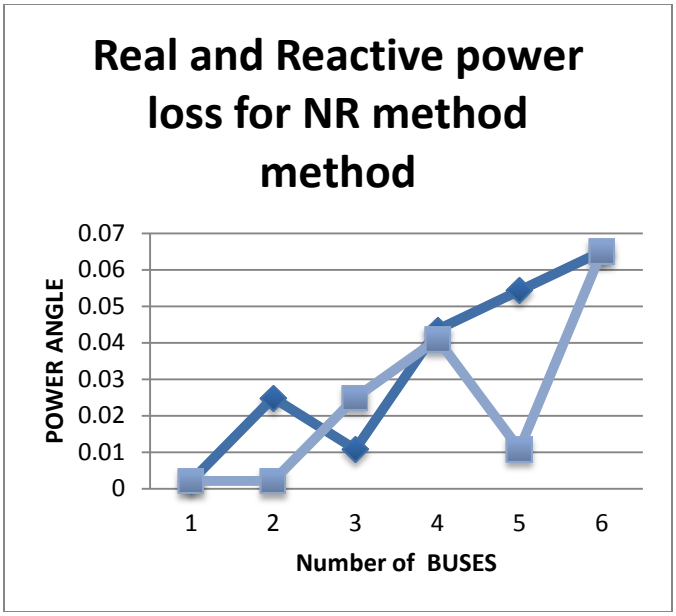

Fig 1.2. Variation of real and reactive power loss

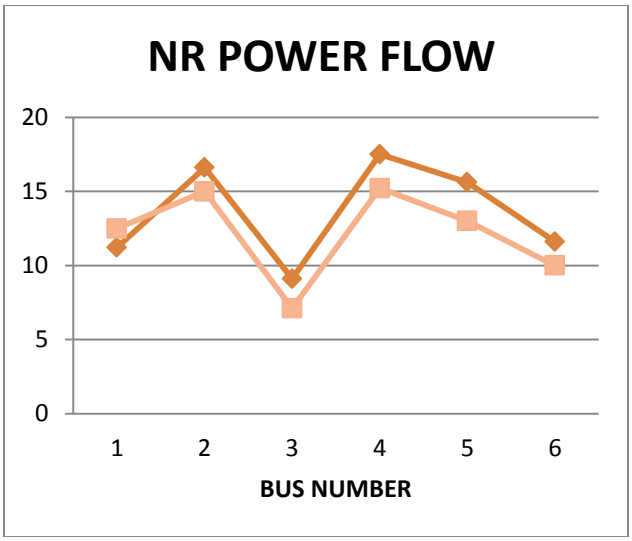

Fig 1.3 power flow using newton raphson and decoupled load flow method

5.CONCLUSION

In the presented work fault analysis and load flow analysis in power system has been carried out.The variation of active and reactive power demands with magnitude of voltage at different buses in load flow analysis has been studied. The reactive power modelling greatly affects the

voltage difference, whereas the active power modelling has a greater effect on phase angle differences. The objective of this work was to develop a comprehensive formulation and an efficient solution algorithm for power flow problem which consider the detailed and extensive modeling that is required for distribution environment of a real world power system.

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