Load Flow Analysis Using MI Power Software

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ABSTRACT

The paper helps to know the basic of Optimal Load Flow Analysis of power system. Load Flow Analysis are used to validate that the power transfer from generators to consumers through the grid system is stable, reliable and economical. Load flow analysis is very useful for stability analysis, future expansion planning and in determining the best economical operation for existing systems. Load flow analysis also helpful for now the proper setting of the protection devices. Power system analysis also help to ensure to know that the safe operation of cables, transformer, transmission lines and other components of power system. Various data of power system like active power, reactive power, load angle, power factor, thermal limit are has to be known.

KEYWORDS: Load flow analysis, contingency analysis, line loading, power system operation.

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1. INTRODUCTION

A well-designed system saves on cost in implementing and maintenance. The primary tools for analysis for steady state operation is so called power flow analysis or Load flow studies where the voltage and power flow through the system is determined\(^1\). Another very popular steady state analysis tool is the short circuit analysis for determining the fault current through system. Load flow analysis helps us to determine flows of power in system during normal and emergency conditions and study the transient behaviour of the system resulting from fault conditions and switching operations. A power system is "secure" when it can withstand the loss of one or more elements and still continue operation without major problems.

OBJECTIVES OF POWER SYSTEM STUDY

- Power flow analysis is very important in planning stages of new networks or addition to existing ones like adding new generator sites, meeting increase load demand and locating new transmission sites.
- It is helpful in determining the best location as well as optimal capacity of proposed generating station, substation and new lines.
- The line status should be known. The line should be not overvoltage it means it should not operate near the thermal limit or closed to stability.

2. LOAD FLOW ANALYSIS

Power flow analysis is the backbone of power system analysis and design. The most important information is known from the load flow is the voltage profile in the system. If voltage varies in the system, large reactive power due to which there is increase in real power loss and in some extreme cases voltage collapse\(^2\). If due to demand increase additional lines is to be required a load flow analysis is help how it will relieve overload adjacent lines. With the help of load flow analysis one can also know the study performance of the Transformer, Transmission line, and Generator at steady state\(^3\). For load flow analysis there are various methods like N-R METHOD, GAUSS-SIEDELMETHOD, FAST ECOPLE LOAD FLOW METHOD, among this we are using the N-R METHOD which has the below benefits among the other methods.

<table>
<thead>
<tr>
<th>LOAD FLOW TECHNIQUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauss-Siedel Method</td>
</tr>
<tr>
<td>Newton-Raphson Method</td>
</tr>
<tr>
<td>Fast Decoupled Load Flow</td>
</tr>
</tbody>
</table>
**Advantages of N-R METHOD**

- One of the fastest method convergences to the root
- Easy to convert to multiple dimensions
- More accurate and not sensitive to the factors such like slack bus selection, regulation transformers etc. and the number of iterations required in this method is almost independent of system size

![Figure:1 Load flow studies method](image)

### 3. MI POWER SOFTWARE

Mi Power is a highly interactive, user friendly windows-based Power System Analysis package. It includes a set of modules for performing a wide range of power system design and analysis study. By using the MI-power software we can able to do VARIOUS ANALYSIS FOR POWER SYSTEM like fault analysis, Contingency analysis, Power flow analysis/load flow analysis, Frequency analysis, Protection coordination and others.
4. SYSTEM UNDER STUDY

Figure 2 shows the single line diagram of the system under study in MI Power software.

Table 1: Load Details

<table>
<thead>
<tr>
<th>BUS NO</th>
<th>MW</th>
<th>MVAR</th>
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<tbody>
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<tr>
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<tr>
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<td>BUS 13</td>
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<td>BUS 14</td>
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</table>
The effective and most reliable amongst the three load flow methods is the Newton-Raphson method because it converges fast and is more accurate. In the load flow analysis methods simulated, the tolerance values used for simulation are 0.001 and 0.1.

5. RESULT FILE

Table: 4 BUS VOLTAGE AND POWER WITHOUT ANY CONTIGENCY

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<th>Bus No.</th>
<th>Magnitude Per Unit</th>
<th>Phase Angle Degrees</th>
<th>Real MW</th>
<th>Reactive MVAR</th>
<th>Real MW</th>
<th>Reactive MVAR</th>
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### Table: 5 BUS VOLTAGE AND POWER WITH CONTIGENCY WHEN GENERATOR 1 IS OPEN

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### Table: 6 BUS VOLTAGE AND POWER WITH ANY CONTIGENCY WHEN LINE 1-2 OPEN

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Table: 7 LINE FLOW AND LINE LOSSES WITH CONTIGENCY LINE1-2 OPEN

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<th>Reactive MVAR</th>
<th>Real MW</th>
<th>Reactive MVAR</th>
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### Table: 8LINE FLOW AND LINE LOSSES WITHOUT CONTIGENCY

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<th>FORWARD</th>
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## LINE FLOW AND LINE LOSSES WITH CONTIGENCY GENERATOR 1

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<thead>
<tr>
<th>SR No.</th>
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Table: 9 LINE FLOW AND LINE LOSSES WITH CONTIGENCY GENERATOR 1

## LINES LOADING DETAILS

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<th>LINE %</th>
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<th>WITH CONTINGENCY WHEN GENERATOR 1 OPEN</th>
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<tr>
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<tr>
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<tr>
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CONCLUSION

This paper represents the load flow analysis by Newton Raphson flow techniques using MI power software which reduced the number of iterations. The software helps to analyse power system operation in an efficient manner and leads the system to effective utilization of power and voltage. Simulation analysis of diagram gives details of system parameters which is highly influence stability and reliability. From the results file we can observe that due to contingency the line loading are changes and power flow also change. Hence this study is very important for power system and analysis.

REFERENCES