

Load Flow and Transient Stability Analysis using Mipower Software

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Abstract— The load flow analysis is the Basic of electrical power system design, electrical power system planning, etc. This paper explains about the Mi power software which it raises the efficiency of load flow and Transient stability analysis. In this paper we have explained about the performance of load flow analysis and Transient stability analysis by using a Mi power technology. This paper Investigate to the stability performance with useful of Mi power technology. This paper explains the different load flow analysis and also the optimization technique used in Fast Decoupled method and also provides the contingency analysis in the load flow technique. The comparison of different methods of load flow technique has been provided. The real and reactive power limits has been sets and Results are obtained.

Keywords: LoadFlow, MIPOWER, Transient Stability

I. INTRODUCTION

An electrical power framework comprises of age, transmission and dissemination. The transmission framework supply mass power and the appropriation framework move electric capacity to a definitive purchaser. The age of electric vitality is only the transformation of one form of vitality into the electrical vitality. Electrical vitality is created in hydro, warm and atomic power stations sometimes electrical vitality is produced from non-sustainable power source assets like wind, waves, and petroleum derivatives and so on. The producing voltages are generally 6.6Kv, 10.5kV, 11kV, 13.8kV, 15.75Kv, and so on.

A. Generator:

Generator is a gadget which changes over mechanical vitality into electrical vitality. Producing voltages are ordinarily 6.6Kv, 10.5kv, (or) 11kv. This creating voltage is step up to 110kv/132kv at the producing to lessen the current in transmission line and to decrease transmission misfortunes. Generator produces genuine power (MW) and responsive power (MVAR).

B. Transformer:

It is a static gadget which moves power or vitality starting with one circuit then onto the next circuit without change of recurrence. The primary capacity of transformer are step up voltage from the lower age levels to the higher transmission voltage levels and furthermore step down voltages from higher transmission voltage levels to the lower conveyance voltage levels. At the point when we are expanding the transmission voltage, current moving through the framework diminishes, there by transmission misfortunes lessens.

C. Types of Buses:

Buses are of 3 types and are classified as:

1) PQ bus – the genuine power |P| and receptive power |Q| are indicated. It is otherwise called Load Bus. By and large, in a PQ transport, the produced genuine and

receptive power will be thought to be zero. In any case, power will stream out, in this way, the genuine power and receptive power will be both negative. The Load Bus will be utilized to discover the transport voltage and point

- 2) PV bus –the genuine power |P| and the voltage extent |V| are indicated. It is otherwise called Generator Bus. The genuine power and voltage are determined for transports that are generators. These transports have a consistent power age, controlled through a prime mover, and a steady transport voltage,
- 3) Slack bus – to adjust the dynamic and receptive power in the framework. It is otherwise called the Reference Bus or the Swing Bus. The leeway transport will fill in as a precise reference for every single different buss in the framework, which is set to 0°. The voltage greatness is likewise thought to be 1 p.u. at the leeway transport.

II. LITERATURE SURVEY

Literature survey to be a more important advance in programming improvement process. Before working up the instrument it is imperative to choose the time factor, economy and companions quality. At the point when these things are satisfied, by then subsequent stages to be in the direction of outline away which operational structure along with words be capable of to be a utilize used for construction to be apparatus. When the developers start constructing the apparatus the software engineers need division of surface facilitate. This facilitate be capable of gotten beginning leading software engineers, beginning volume otherwise beginning site.

III. LOAD FLOW ANALYSIS

A. Power Flow Analysis:

In control designing, the power-stream study, or burden stream learning, to be a mathematical investigation is to be a progression in stimulating influence within organized framework. A power-stream study typically utilizes disentangled documentations, for example, a one-line chart and per-unit framework, and spotlights on different parts of AC control parameters, for example, voltages, voltage edges, genuine control and responsive power. It breaks down the power frameworks in ordinary enduring state activity. Power-stream or burden stream reads are significant for arranging future development of intensity frameworks in a minute at the same time in deciding most excellent activity of obtainable frameworks.

three methods for load flow studies,

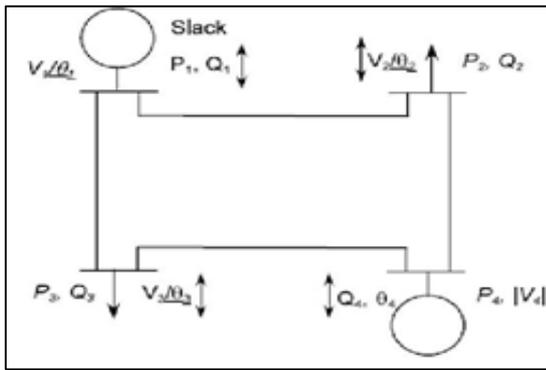


Fig. 1: Bus diagram

- 1) Gauss Siedel system
- 2) Newton Raphson system
- 3) Fast Decoupled system

Power stream examination is significant in arranging phases latest systems option in the direction of accessible one approximating including latest generator destinations, satisfying increment weight need along with finding latest transmissions locales.

This is a heap stream arrangement give to nodal voltages another stage edges are consequently these authority infusion by the side of transports and power moves all the way through interconnect power channel. It is useful in deciding to be a best area just the same as ideal limit of proposed creating station, substation and new lines

B. Gauss Seidel Method:

The strategies are created dependent scheduled the Gauss technique. In this a iterated technique utilized designed for settling position as a nonlinear arithmetical conditions. This technique utilizes an underlying speculation for estimation of voltage, to acquire a determined estimation of a specific variable. The underlying supposition esteem is supplanted by a determined worth. The procedure is then rehashed until the cycle arrangement meets. The intermingling is very touchy to the beginning qualities accepted. Be that as it may, this strategy experiences poor intermingling qualities.

$$V_i^{(k+1)} = \frac{\frac{P_i^{sch} - jQ_i^{sch}}{V_i^*} + \sum y_{ij} V_j^{(k)}}{\sum y_{ij}} \quad j \neq i$$

Utilizing Kirchoff present rule, it is to be expected so as to the present infused interested in transport I is sure, at that point the genuine and the responsive forces supply into the transports, for example, generator transports, and have a positive worth. The genuine and the responsive forces streaming endlessly from the transports, for example, load transports and have negative qualities. P I nd Q I are unraveled

$$P_i^{(k+1)} = \text{Real} \left[V_i^{*(k)} \left\{ \sum_{i=0}^n y_{ij} - \sum_{ji} V_i^{(k)} \right\} \right] \quad j \neq i$$

$$Q_i^{(k+1)} = \text{Imaginary} \left[V_i^{*(k)} \left\{ \sum_{j=1}^n y_{ij} - \sum_{ji} V_i^{(k)} \right\} \right] \quad j \neq i$$

C. Newton Raphson Method

These technique was name following Isaac Newton and Joseph Raphson. These starting point in addition to definition

of Newton-Raphson technique was gone backside in the direction of behind schedule 1960s. In this a iterated technique and approximated a bundle as an non-straight synchronous conditions set of direct concurrent conditions utilizing Taylor's arrangement extension and the terms are restricted to the main estimate. It is the most iterative strategy utilized for the heap stream since its union qualities are generally progressively incredible contrasted with other elective procedures and the dependability of Newton-Raphson move toward is similarly great ever since it be capable of settle suitcases that guide disparity by way of additional mainstream forms.

$$I_i = \sum_{j=1}^n |Y_{ij}| |V_j| < \theta_{ij} + \delta_j$$

$$P_i - jQ_i = V_i^* I_i$$

D. Fast Decoupled System:

Fast Decoupled system is single of better strategies, It depends inactive of disentanglement on Newton-Raphson strategy .These strategy, similar to the Newton-Raphson technique, offer estimation rearrangements, quick assembly and dependable outcomes and turned into a broadly utilized strategy in load stream examination. Be that as it may, quick decouple for certain cases, anywhere elevated protection from reactance (R/X) proportions or substantial stacking at certain transports are available, doesn't merge well since it is an estimation strategy and make some presumption to improve Jacobian grid. designed for these suitcases, numerous endeavors and advancements has to be a made to beat this combination obstructions. a few of them focused on the intermingling of frameworks with high R/X proportions

$$\begin{bmatrix} \Delta P \\ \Delta Q \end{bmatrix} = \begin{bmatrix} J_1 & 0 \\ 0 & J_4 \end{bmatrix} \begin{bmatrix} \Delta \delta \\ \Delta |V| \end{bmatrix}$$

IV. STABILITY ANALYSIS:

The primary electrical control framework is a direct current framework worked in 1882. These resulting power frameworks so as to be developed as to be a behind nineteenth hundred be all direct current frameworks. Anyway notwithstanding these underlying notoriety direct current frameworks by means of twentieth hundred air conditioning frameworks began to dwarf them. The air conditioner frameworks were believed to be predominant as air conditioning machines were less expensive than their dc partners and all the more critically air conditioning voltaged is an effectively transform starting first stage in the direction of o utilizing transformer.

A. Stability in Power System:

Steadiness is an electric framework and so on capacity are come back and ordinary are steady working situation in the wake of having been exposed to some type of unsettling influence. On the other hand, precariousness implies as a situation meaning failure as a synchronism are dropping away from this step. Besides, security it's a propensity on the power framework to create reestablishing powers equivalent to or more prominent than the upsetting powers so as to keep up the condition of two harmony. These frameworks are

assumed a stay steady, in these powers attention in the direction of grip equipment during synchronism by means of each other an adequate the defeat an upsetting powers.

The soundness of a framework alludes towards a capacity on framework it's come back an enduring situation while exposed an aggravation. Electric Power are created as a result of synchronism generators that work in synchronous by means of remainder of the framework. A generator is synchronism as a transport while these two has some recurrence, voltages as a stage arrangement. Power framework solidness be able to characterized and its capacity on electric power framework come back as a unfaltering situation with no down synchronized. Generally control framework steadiness is sorted as a stable condition Transient and Dynamic strength

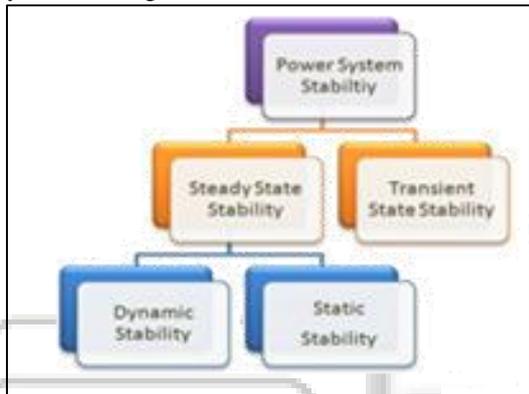


Fig. 2: Power System Stability

B. Transient Stability:

Transient solidness to be a capacity power framework to keep up synchronism as soon as exposed to a serious passing unsettling influence, for example, the event of a deficiency, the abrupt blackout of a line or the unexpected application or expulsion of burdens. The subsequent framework reaction includes enormous trips on generators rotors edges and it's impacted through to nonlinear power-point association follow as a unexpected unsettling influences is an electric power framework, rotor rakish contrasts, rotor speed and power move experience quick changed whose sizes is needy upon a seriousness on aggravations. It is an huge unsettling influence, changed is a rakish contrasts might subsist as enormous are make to an engine drop away from the stride These kind as a insecurity are identified as a Transient Instability. Transient strength as a quick wonder, ordinarily happening inside one second for a generator near the reason for aggravation. The goal of the transient strength study is to learn whether the heap edge comes back to an enduring worth after the leeway of the unsettling influence.

Contrasts more than point interim in issue other in the critical flaw and fast and could be allowed. These flaws clearance evacuates at least Single transmitted components and debilitates the framework. These adjustments in these transmitted framework construct modify is a generator rotor edges. On the off chance that the progressions are with the end goal that the quickened machines get extra burden, they delayed down and another balance position is come to. The loss of synchronism will be clear inside one moment of the underlying unsettling influence.

C. Causes of Transient Stability

Homeless people are aggravations that happen for a very brief span and the electrical circuit is immediately reestablished to unique activity gave no harm has happened because of temporary in electric temporary to be a circumstance in addition to logical results marvel. Designed for homeless people happen nearby should be a source a portion of most typical reasons for drifters:

- 1) full of atmosphere phenomenon
- 2) Switch and loads turn on or turn off
- 3) Disruption of mistake current
- 4) Switch of authority position

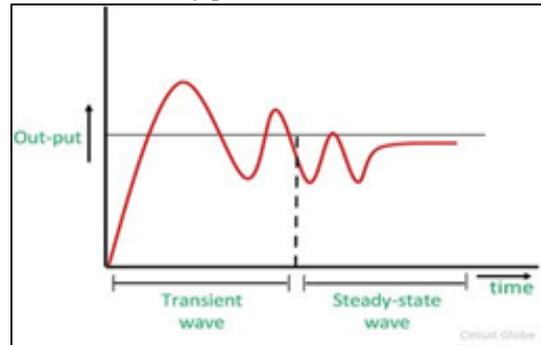


Fig. 3: Transient and Steady-State Disturbances

Security reads are useful for the assurance of basic clearing time of circuit breakers, voltage levels and an exchange capacity of the frameworks.

V. MI POWER SOFTWARE

Mi Power is a profoundly intelligent, easy to use window base control scheme investigation bundle. The incorporates a grouping of module for playing out a extensive scope are intensity framework plan and examination learning. Mi Power highlights incorporate a first rate window GUI by means of unified folder. Relentless condition, temporary and electro-attractive passing investigation can be performed with most extreme exactness and resilience. Intended to evaluate the danger of Voltage insecurity and edge of dependability during unexpected unsettling influences, under consistent state conditions. It positions the heap transports dependent on the L-record esteem and the most elevated L-list demonstrates the framework breakdown indicate. Perform three-stage symphonious burden stream to register consonant twisting elements. Computes consonant exchange & driving indicate "Z" used for mutually communication & appropriation control frameworks.

A. Load Flow Analysis:

- 1) regularity reliant best possible load, Alternating Current/ Direct Current flow
- 2) various islanded system
- 3) modified statement capability
- 4) MW & MVAR Optimization
- 5) emergency position & investigation

B. Transient Stability Study:

- 1) Various kinds of deficiency at client characterized area
- 2) full portrayal of excitation system turbines committee static var
- 3) Load cracking

- 4) Simulation of activity of V/I/recurrence transfers in addition to division transfer

C. Features:

- 1) Linear, semi-log, log scales
- 2) Curve Tracing
- 3) Superimpose multiple graphs
- 4) User defined X - Y axis labels
- 5) Device co-ordination using curves
- 6) Harmonic Analysis of obtained graphs
- 7) Mathematical operations on obtained curves
- 8) Use of Symbols for curve identification
- 9) Flexible Axis alignment
- 10) Provision for modifying data at any time

D. Short Circuit Analysis:

- 1) Fault levels for symmetrical and asymmetrical faults.
- 2) ANSI/IEEE standards
- 3) IEC standards including 363 & 909
- 4) All sorts of balanced and lopsided shortcomings with and without impedance

E. Voltage Instability Analysis:

Intended is to be a survey and danger is Voltage insecurity in addition to edge are solidness for the period of abrupt unsettling influences, below unfaltering situation. It positions to be a heap transports dependent on top of the H-list esteem in addition to the most elevated H-file demonstrates the framework breakdowns indicate.

VI. SOFTWARE IMPLEMENTATION

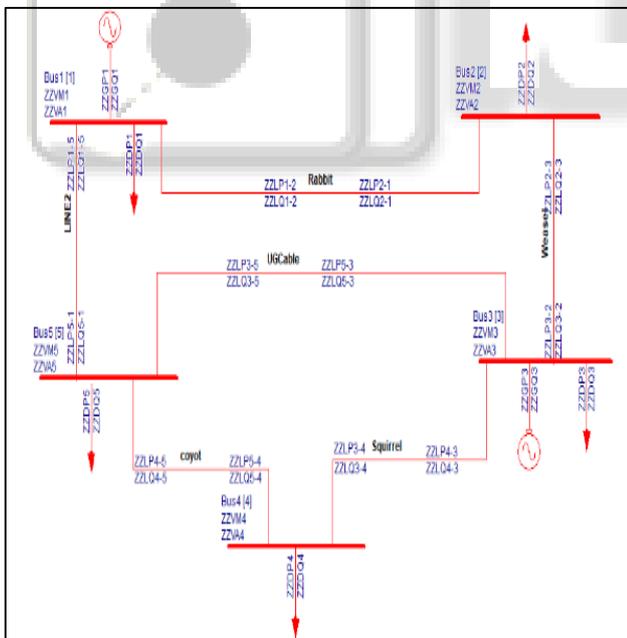


Fig. 4: Bus system of power flow analysis

VII. OUTPUT

***** OUTPUT DATA *****

Total Specified MW Generation: 480.000
 Total Minimum MVA_r Limit of Generator : 0.0
 Total Maximum MVA_r Limit of Generator : 310.30
 Total Specified MW Load: 405.00Changedto405.

Total Specified MVA_r Load: 200.00000Changedto200.
 Total Specified MVA_r Compensation: 0.000Changedto0

 Total (Including Out of Service Units)
 Total Specified MW Generation: 480.00
 Total Minimum MVA_r Limit of Generator: 0.00000
 Total Maximum MVA_r Limit of Generator: 310.30000
 Total Specified MW Load: 405.00 Changed to 405.00
 Total Specified MVA_r Load: 200.0 Changed to 200.00
 Total Specified MVA_r Compensation: 00 Changed to 0.00
 |***** SUMMARY OF RESULTS *****|
 TOTAL REAL POWER GENERATION
 (CONVENTIONAL) : 238.757 MW
 TOTAL REAL POWER INJECTION (-ve LOAD) : 0.000 MW
 TOTAL REACT. POWER GENERATION
 (CONVENTIONAL): 191.847 MVA_r
 GENERATION p.f. : 0.780
 TOTAL REAL POWER GENERATION (WIND): 0.000 MW
 TOTAL REACT. POWER GENERATION (WIND): 0.000 MVA_r
 TOTAL REAL POWER GENERATION (SOLAR): 0.000 MW
 TOTAL REACT. POWER GENERATION (SOLAR): 0.000 MVA_r
 TOTAL SHUNT REACTOR INJECTION: -0.000 MW
 TOTAL SHUNT REACTOR INJECTION: -0.000 MVA_r
 TOTAL SHUNT CAPACIT.INJECTION: -0.000 MW
 TOTAL SHUNT CAPACIT.INJECTION:-0.000 MVA_r
 TOTAL TCSC REACTIVE DRAWL: 0.000 MVA_r
 TOTAL SPS REACTIVE DRAWL: 0.000 MVA_r
 TOTAL UPFC INJECTION: -0.000 MVA_r
 TOTAL SHUNT FACTS INJECTION: 0.000 MVA_r
 TOTAL SHUNT FACTS DRAWAL: 0.000 MVA_r
 TOTAL REAL POWER LOAD: 279.454 MW
 TOTAL REAL POWER DRAWAL (-ve gen.): 0.000 MW
 TOTAL REACTIVE POWER LOAD: 140.733 MVA_r
 LOAD p.f.: 0.893
 TOTAL COMPENSATION AT LOADS: 0.000 MVA_r
 TOTAL HVDC REACTIVE POWER: 0.000 MVA_r
 TOTAL REAL POWER LOSS (AC+DC): 12.314154 MW
 (12.314154+ 0.000000)
 PERCENTAGE REAL LOSS (AC+DC): 5.158
 TOTAL REACTIVE POWER LOSS: -813.791955 MVA_r

VIII. TABULATION

Line, Bus to Bus	Length km	R in p.u.	X in p.u.	Charging MVA _r	Positive sequence Susceptance (B/2)	Thermal rating
1-2	64.4	0.042	0.168	4.1	0.0205	100
1-5	48.3	0.031	0.126	3.1	0.0155	100
2-3	48.3	0.031	0.126	3.1	0.0155	100
3-4	128.7	0.084	0.336	8.2	0.041	100
3-5	80.5	0.053	0.210	5.1	0.0255	100
4-5	96.5	0.063	0.252	6.1	0.0305	100

Susceptance B/2 = (Charging MVA_r / Base MVA) / 2

Table 1: Transmission Line Data

NAME	Generator 1	Generator 2
De-rated MVA	500	225
Scheduled power	300	180
Real power minimum	0	0
Real power maximum	300	180
Reactive power minimum	0	0
Reactive power maximum	200	110.3

Table 2: Generator Data

Load number	Load-1	Load-2	Load-3	Load-4	Load-5
Bus number	1	2	3	4	5
Real power in MW	65	115	70	70	85
Reactive power in MVAR	30	60	40	30	40

Table 3: Load Data

IX. CONCLUSION

This task speaks to the heap stream investigation and Gauss siedal, Newton Raphson and Fast Decoupled burden stream procedures by Mi Power programming which recedues the emphasis level in the quantity of transports. The product tackles the heap stream procedure in a proficient way and leads the framework to compelling usage of intensity and voltage. The possibility examinations have likewise been acquired for business offices, utility circulation framework. This Project finishes up the power framework recreation by having long haul age and transmission, momentary operational reproduction and market examination, for example, load anticipating.

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