Shri Ramdeobaba College of Engineering and Management, Nagpur (MS)

(An Autonomous Institution Permanently affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
An ISO 9001:2015 Certified Institution. NAAC Certified 'A' Grade

Department of Electrical Engineering
Laboratory Manual

Power Systems II Laboratory

EEP 371

(VI Semester Electrical)

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Vision

Department of Electrical Engineering endeavours to be one of the best departments in India having expertise to mould the students to cater the needs of society in the field of technology, leadership, administration, ethical and social.

Mission

To provide dynamic and scholarly environment for students to achieve excellence in core electrical and multidisciplinary fields by synergetic efforts of all stake holders of the Electrical Engineering Department and inculcate the ethical and social values.

Programme Educational Objectives (PEOs)

PEO 1. Our graduates will be able to plan, design, operate and practice in electrical and energy systems.
PEO 2. Our graduates will be able to work in multidisciplinary environments including IT applications and adapt themselves as per the emerging technological needs of Industry.
PEO 3. Our graduates will be able to progress in their career by demonstrating in practice the technical and communication skills effectively with understanding of ethical and social values

Program Outcomes and Program Specific Outcomes (UG)

Our electrical engineering graduates will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals to the solution of engineering problems.

PO2. **Problem analysis**: Identify, formulate, review literature, and analyze complex engineering problems using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public safety, societal and environmental considerations.

PO4. **Conduct problem investigations**: Use research-based knowledge including experimentation, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Select, and apply appropriate techniques, resources, and modern engineering and IT tools for analyzing the engineering activities with an understanding of the limitations.

PO6. **The engineer, industry and society**: Apply contextual knowledge to assess industrial, societal and safety related issues and understand consequent relevance to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. **Communication**: Communicate effectively on complex engineering activities such as, being able to understand and write effective reports, make effective presentations, and give and receive clear instructions.
PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team in multidisciplinary environments.
PO12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO 1. Analyse, design and develop electrical engineering systems considering green energy aspects in emerging applications like electric vehicles, renewable energy etc.
PSO 2. Apply the knowledge of modern IT tools to Electrical Engineering applications.

Course Objectives

The objective of the course is to:

1. Make students familiar with concepts and analysis of power systems
2. Make students familiar with prototype model of power system
3. Make students able for understanding, analyzing performance of power system
4. Make students able to understand and correlate the theory with experiments based on power system.

Course Outcomes

Upon successful completion of the course, the student shall be able to

1. Apply and analyze fundamental principles of power system Engineering with laboratory experimental work and programming work
2. Understand and perform the experiment, Analyze the observed data & make valid conclusion
3. Write Journal with effective presentation of diagrams and characteristics
4. Use the modern software like MATLAB for plotting and analyzing power system

Mapping of CO with PO and PSO

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	3											3	2
2	3	3											3	2
3	3	3											3	2
4	3	3											3	2

Rubrics for laboratory work evaluation and evaluation Scheme

Parameter=>	Attendance and Performance		Journal Writing		Viva-Voce	
COs Addressed	1,2,4		2,3		1,2	
Total Marks	10		10		5	
Marks Distribution (Sub-Parameters)	Present	2	Clarity of Aim	2	Understanding of Aim	1
	Proper simulation	2	Clarity of Circuit dig.and simulation diagram	2	Understanding of Theory Behind the Experiment and simulation	2
	Understanding of Experiment Performance	4	Clear Understanding of Calculations and simulation results	2	Understanding of practical Applications	2
	Correct Observations	2	Validity of Result	2		
			Conclusion	2		

Laboratory experiment index

1. Study of transmission Line Model
2. To study methods for load flow analysis.
3. Study of PSAT software for MATLAB
4. To simulate transmission line model and perform load flow analysis using PSAT
5. To simulate six bus system and perform load flow analysis using PSAT
6. To study Ferranti effect on long transmission line using PSAT
7. To study dynamic response of change in frequency of isolated single area system
8. Three phase fault analysis using Power World Simulator

Laboratory experiment details

All the experiments are to be performed on Simulation Softwares like MATLAB,PSAT and Power World Simulator

Experiment 1

Study of Transmission Line Model

The transmission line model used in the project is High Voltage Transmission Line Analyser

(VPST-100HV1). This model comprises of five sections, which are: -

a. Generating Station
b. Transmission Line Model c. Receiving Station
d. Compensator Section e. RLC Loading Section

a. Generating Station

The Generating Station is shown with a generator model from which the line is fed, the sending end is provided with a step up transformer from which different ranges of voltage ranging from 110/220V can be obtained. Figure 1 shows the generating station and dimmerstat attached with the generating station.

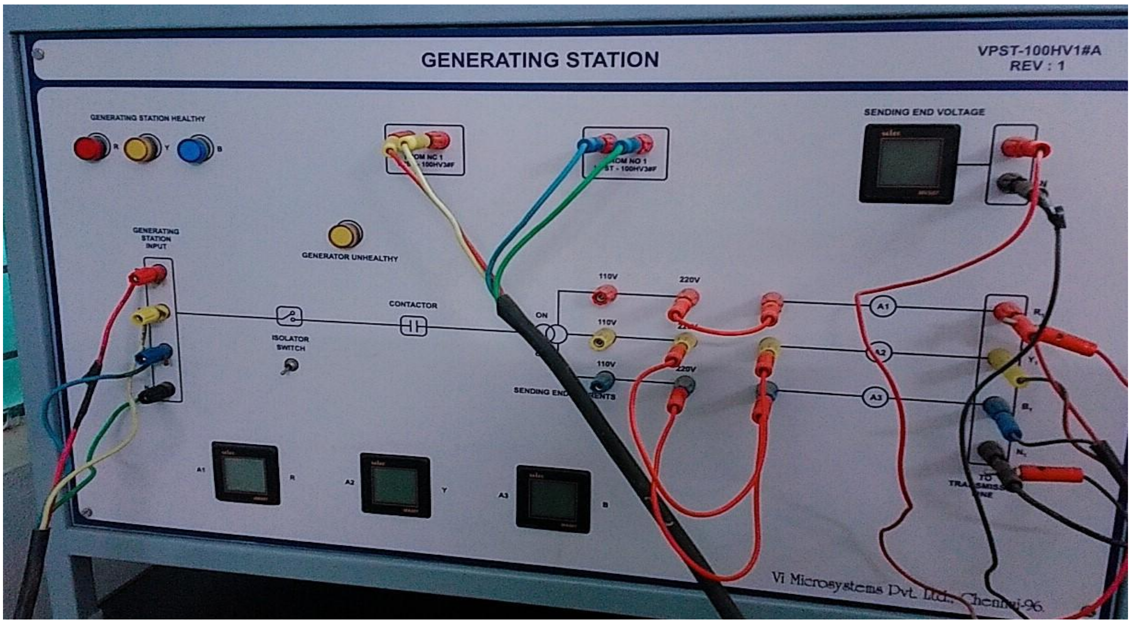


Figure 1 A. Generating Station

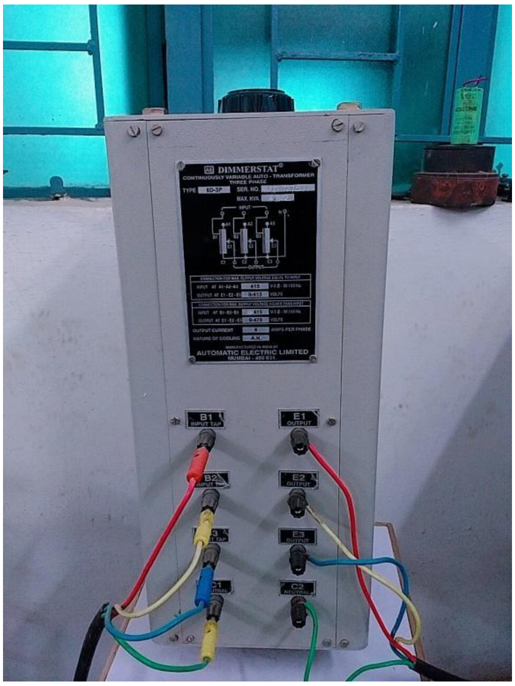


Figure 1 B. Dimmerstat attached generating station

b Transmission Line Model

The transmission line is considered for length of 180 km. The line may be used as 180 km, 3ϕ line or 540 km, 1ϕ line. The line inductance is taken for every 30 km and capacitance for every 15 km. The actual value of line parameters of 220 KV transmission line are 0.03333Ω/km,1.06mH/km and 7.33nF/km. Figure 2 shows the arrangement of transmission line model.

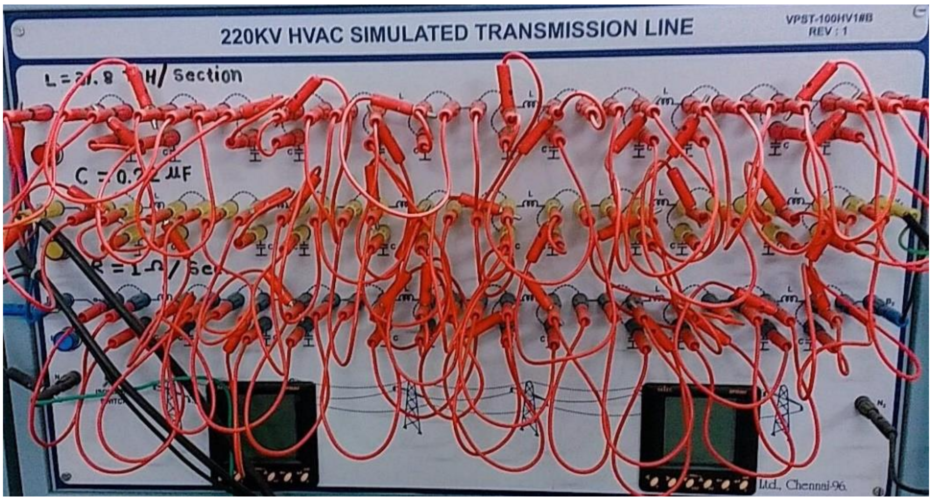


Figure 2 Transmission Line Model

c. Receiving Station

The receiving station is provided with a step down transformer from which different ranges of voltage ranging from 110/220V can be obtained. Figure 3 shows the Receiving Station.

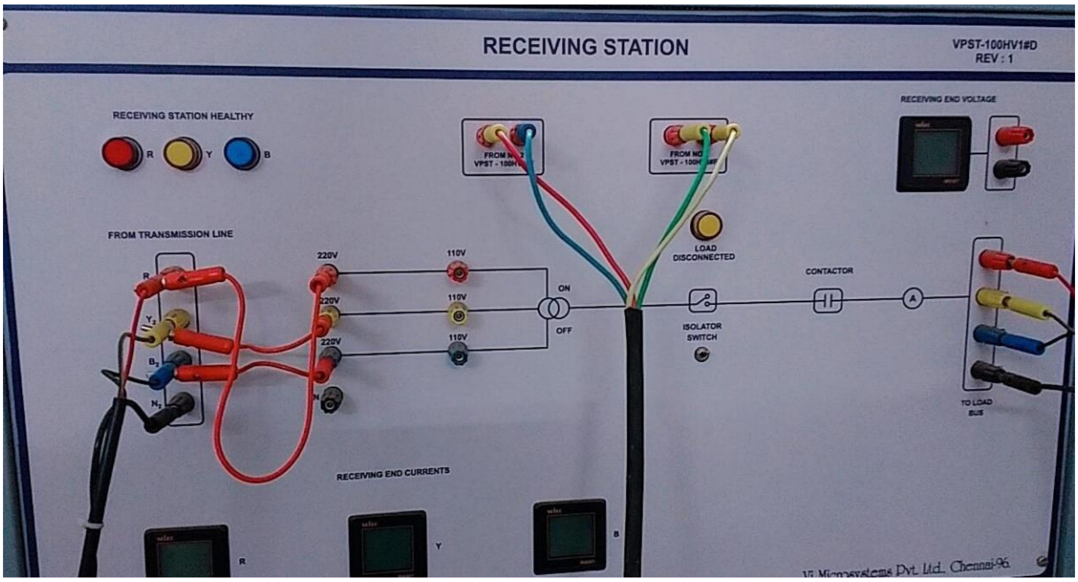


Figure 3 Receiving Station

d. Compensator Section

It consists of shunt capacitors for voltage control and series reactor to reduce the fault current during fault conditions.

- Shunt capacitor: 3 ϕ delta connected shunt capacitor of 1 KVAR – 4 numbers are available as independent units.
- Shunt reactor: A 3 numbers of 0 to 1700mH variable inductance available for compensation under no load condition.
- Series reactor: Series reactor with inductance 0mH to 120mH available in all the three phases for series compensation.

e. RLC Loading Section

The loading section is provided with resistive load, Inductive load. The loading section is also provided with an ammeter to measure the load current and a voltmeter to measure the load end voltage. Figure 4 shows the Compensator section and RLC loading section

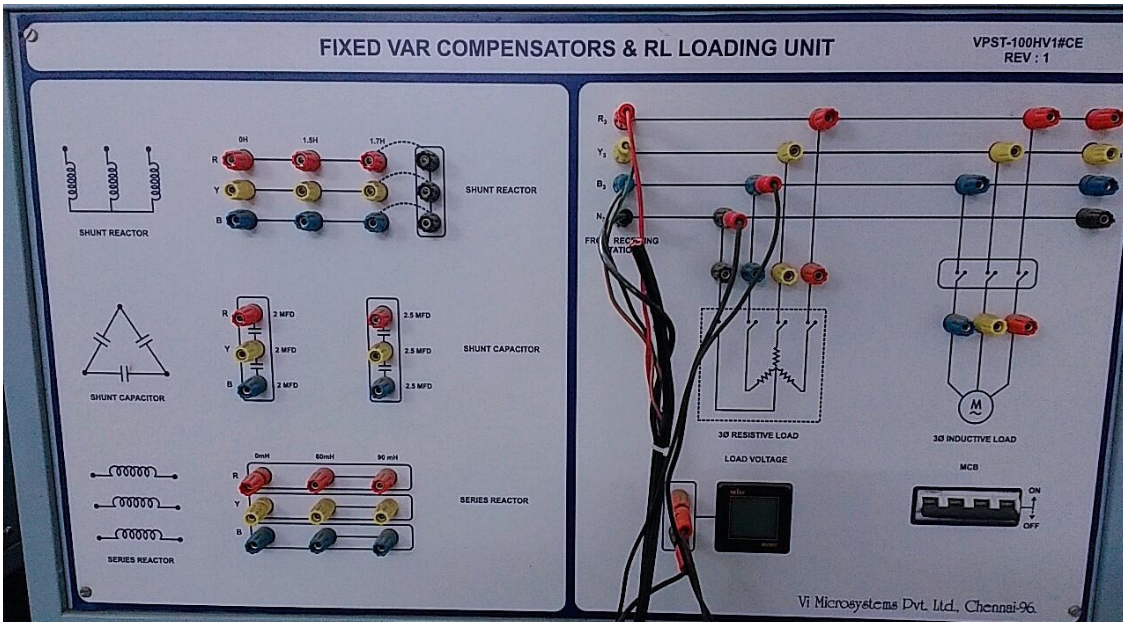


Figure 4 Compensator and RLC Loading Section

Experimentation work

The experiments can be conducted by connecting loads at different locations. The currents in various sections of transmission line, voltages on each bus, total powers consumed by the load can be obtained.

1. Resistive Load at the end
2. Induction Motor Load at the end
3. Resistive and Induction Motor Load at the end
4. Simultaneous Loading at the end with intermediate induction motor load

Experiment 2
Study of Load Flow Methods

What is "Load Flow"?

- Load flow is the steady state solution of the power system network.
- The main information obtained from the load flow study comprises of

  -The magnitudes and phase angles of bus voltages.

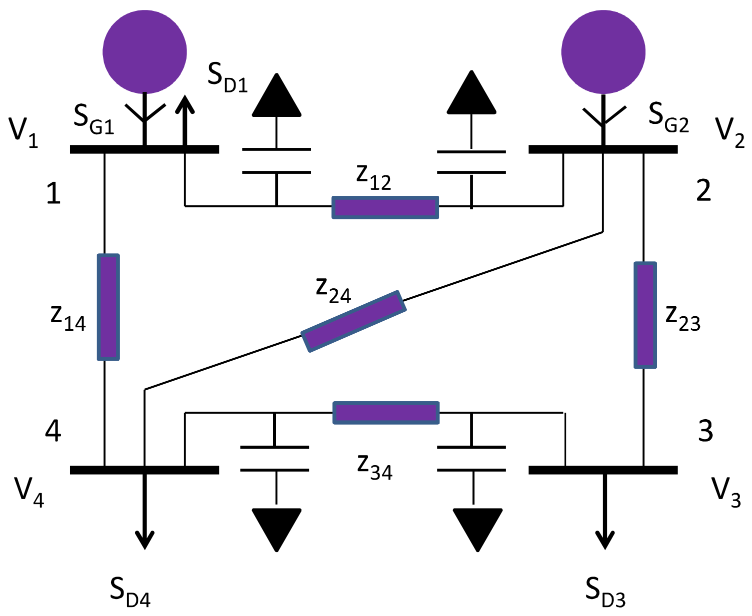
  -Power flows in transmission lines.

Need of Load Flow?

- Operation and control.
- planning.
- stability analysis.
- fault analysis.
- Security analysis.
  - System monitoring
  - Contingency analysis
  - System state classification

Bus Admittance Matrix

Consider a simple power system network



Complex power generated at i^{th} bus

$$S_{Gi}= P_{Gi}+jQ_{Gi}$$

Complex power demand at i^{th} bus

$$S_{Di}= P_{Di}+jQ_{Di}$$

Complex power injected into i^{th} bus

$$S_i= S_{Gi}-S_{Di}$$

Current injected into i^{th} bus

$$I_i= I_{Gi}-I_{Di}$$

V_i - Bus voltage

y_{i0}- self admittance of bus-i

$I_1 = y_{10}V_1 + y_{12}[V_1 - V_2] + y_{14}[V_1 - V_4]$

$I_2 = y_{21}[V_2 - V_1] + y_{20}V_2 + y_{23}[V_2 - V_3] + y_{24}[V_2 - V_4]$

$I_3 = y_{32}[V_3 - V_2] + y_{30}V_3 + y_{34}[V_3 - V_4]$

$I_4 = y_{41}[V_4 - V_1] + y_{42}[V_4 - V_2] + y_{43}[V_4 - V_3] + y_{40}V_4$

$$\Rightarrow \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} y_{10}+y_{12}+y_{14} & -y_{12} & 0 & -y_{14} \\ -y_{21} & y_{20}+y_{21}+y_{23}+y_{24} & -y_{23} & -y_{24} \\ 0 & -y_{32} & y_{30}+y_{32}+y_{34} & -y_{34} \\ -y_{41} & -y_{42} & -y_{43} & y_{40}+y_{41}+y_{42}+y_{43} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix}$$

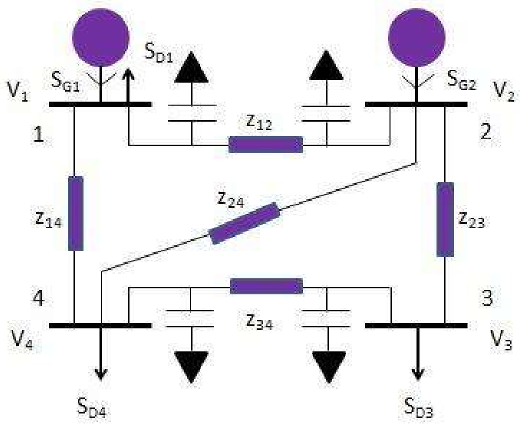
$$\Rightarrow \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} Y_{11} & Y_{12} & Y_{13} & Y_{14} \\ Y_{21} & Y_{22} & Y_{23} & Y_{24} \\ Y_{31} & Y_{32} & Y_{33} & Y_{34} \\ Y_{41} & Y_{42} & Y_{43} & Y_{44} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix}$$

$I_{bus} = Y_{bus}V_{bus}$

$I_1 = Y_{11}V_1 + Y_{12}V_2 + Y_{13}V_3 + Y_{14}V_4$

So we can write , $I_i = \sum_{k=1}^{n} Y_{ik}V_k$,

for i=1,2........n



Bus Admittance Matrix by Inspection

- Diagonal entries,

  $Y_{bus}(i, i)$ = Sum of the admittances of all components connected to node i.

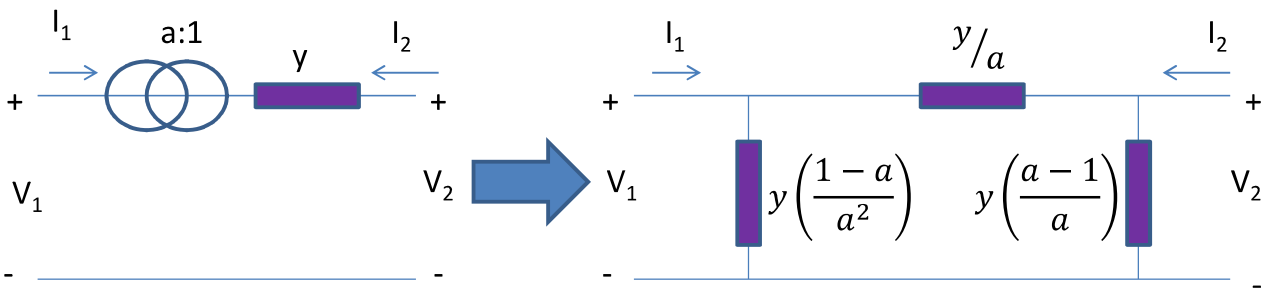
- Off-diagonal entries,

  $Y_{bus}(i, j)$ = Negative of sum of the admittance of all components connected between node i and j.

Is this method always applicable?

Effect of Tap changing Transformers

Let us consider a Tap-changing transformer with turns ratio '1/a' whose admittance is 'y'.



$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{pmatrix} y/_{|a|^2} & -\,y/_a \\ -\,y/_a & y \end{pmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

What will happen if there is a Phase Shifting Transformer?

Inputs and outputs of load flow

- Inputs: real & reactive powers injected into the bus and network parameters
- Outputs: magnitude and phase angles of bus voltages

θ → real power

|V|→ reactive power

Power/load flow equations

Complex power at i[th] bus is given by

$$S_i = P_i + jQ_i = V_i I_i^*$$

$$= V_i \sum_{k=1}^{n} (Y_{ik} V_k)^*$$

for i= 1,2,……………n.

Note: here 'θ' is considered as bus voltage phase angle

let

$$V_i = |V_i|\angle\, \theta_i, V_k = |V_k|\angle\theta_k \;\&\; Y_{ik} = G_{ik} + jB_{ik}$$

$$P_i = \sum_{k=1}^{n} |V_i||V_k|(G_{ik}\cos\theta_{ik} + B_{ik}\sin\theta_{ik}) \longrightarrow \quad (1)$$

$$Q_i = \sum_{k=1}^{n} |V_i||V_k|(G_{ik}\sin\theta_{ik} - B_{ik}\cos\theta_{ik}) \longrightarrow \quad (2)$$

Are these equations linear?

- As these equations are non-linear we have to use iterative methods to solve them.
- For an n-bus system, there will be '2n' equations with '4n' unknowns (P_i,Q_i,$|V_i|$,θ_i at each bus).

How to solve these equations?

Is the solution unique?

Types of buses

1) Generator bus/voltage controlled bus
2) Load bus
3) Slack bus

among 4 variables (P, Q, |V| & θ) two will be specified and the remaining will be unspecified

Type of bus	Specified variables	Unspecified variables
Generator bus	P & |V|	Q & θ
Load bus	P & Q	|V| & θ
Slack bus	|V| & θ	P & Q

Need of slack bus

- Consider we are having 'n' buses ranging from 1 to n.
- If suppose all the given buses are load/generator buses, 'P_i' will be specified in both the cases, so "$P_L = \sum_{i=1}^{n} P_i = \sum_{i=1}^{n} P_{Gi} - \sum_{i=1}^{n} P_{Di}$" is known.
- The term P_L in the above equation is evidently the total I^2R loss in the transmission lines and transformers of the network.
- But the individual currents in the various transmission lines of the network cannot be calculated until after the voltage magnitude and angle are known at every bus of the system.

- There fore, P_L is initially unknown and it is not possible to prespecify all the quantities in the summations of the above eqn.
- In the formulation of the power flow problem we choose one bus ,as slack bus, at which P_i is not scheduled.
- After the power flow problem has been solved, the difference(slack) between the total specified 'P' going into the system at all the other buses and the total output power plus I^2R losses are assigned to the slack bus.
- For this reason a generator bus must be selected as the slack bus.
- The voltage angle of the slack bus serves as reference for the angles of all other bus voltages

Application of Gauss-Seidel method to Load Flow problem

As we know,

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

$$\Longrightarrow \quad I_i = \frac{P_i - jQ_i}{V_i^*} \longrightarrow (3)$$

Also we know current injected into bus i,

$$I_i = \sum_{k=1}^{n} Y_{ik} V_k \longrightarrow (4)$$

From eqns. (3) & (4)

$$\frac{P_i - jQ_i}{V_i^*} = \sum_{k=1}^{n} Y_{ik} V_k$$

$$\Longrightarrow \quad \frac{P_i - jQ_i}{V_i^*} = Y_{ii} V_i + \sum_{\substack{k=1 \\ \neq i}}^{n} Y_{ik} V_k$$

$$\Longrightarrow \quad Y_{ii}V_i = \frac{P_i - jQ_i}{V_i^*} - \sum_{\substack{k=1 \\ \neq i}}^{n} Y_{ik}V_k$$

$$\Longrightarrow \quad V_i = \frac{1}{Y_{ii}}\left[\frac{P_i - jQ_i}{V_i^*} - \sum_{\substack{k=1 \\ \neq i}}^{n} Y_{ik}V_k\right] \longrightarrow \quad (5)$$

for all i=1,2……..n.

eqn. (5) is non-linear because it contains 'v_i^*' term in denominator of the RHS term. In order to linearize eqn.(5) take 'v_i^*' from the previous iteration.

for p^{th} iteration,

$$(V_i)^p = \frac{1}{Y_{ii}}\left[\frac{P_i - jQ_i}{(V_i^*)^{p-1}} - \sum_{k=1}^{i-1} Y_{ik}(V_k)^p - \sum_{k=i+1}^{n} Y_{ik}(V_k)^{p-1}\right]$$

Algorithm for Gauss-Seidel Load Flow with only PQ_buses:

Step 1: make initial guesses for bus voltages as $V_i^{(0)}$ for all i=2,3………,n. and set iteration count p=1.

Step 2: calculate voltages at all buses(i=2,3……,n) by using the relation

$$(V_i)^p = \frac{1}{Y_{ii}}\left[\frac{P_i - jQ_i}{(V_i^*)^{p-1}} - \sum_{k=1}^{i-1} Y_{ik}(V_k)^p - \sum_{k=i+1}^{n} Y_{ik}(V_k)^{p-1}\right]$$

Step 3: calculate the diff. b/w the voltages magnitudes of previous iteration and present iteration for all buses i=2,3,………,n.

$V_i(\text{diff.}) = |V_i^{(p)}| - |V_i^{(p-1)}|$

Step 4:

if

max(V_2(diff),V_3(diff)……,V_n(diff))≤ accuracy, stop iterations

else

set p=p+1 go to step_2.

Handling of PV_buses

We can't use the relation

$$(V_i)^p = \frac{1}{Y_{ii}}\left[\frac{P_i - jQ_i}{(V_i^*)^{p-1}} - \sum_{k=1}^{i-1} Y_{ik}(V_k)^p - \sum_{k=i+1}^{n} Y_{ik}(V_k)^{p-1}\right]$$

In order to find the angle 'θ', because we don't know 'Q' value, but we can use the values of voltages to estimate the 'Q'.

So we first estimate the value of 'Q' for PV_bus

Using the relation

$$Q_i = \sum_{k=1}^{n} |V_i||V_k|(G_{ik}\sin\theta_{ik} - B_{ik}\cos\theta_{ik})$$

convergence properties

- whether the method will converge?
- how fast the method will converge?

For Newton-Raphson method, whether the method will converge or not depends on two things:

1) How close the guessed solution is to the correct solution.
2) The nature of the function close to the correct solution.

The NR-method converges “quadratically”.

Quadratic convergence means that each iteration increases the accuracy of the solution by two decimal places.

N-R Application to Power Flow

- Let **x** be the voltage angle and voltage magnitude, $\mathbf{x} = \begin{bmatrix} \boldsymbol{\theta} \\ |\mathbf{V}| \end{bmatrix}$

Why does the index start at 2?

- Power flow equations: f(**x**) = 0,

$$\overbrace{\sum_{k=1}^{n} |V_i||V_k|(G_{ik}\cos\theta_{ik} + B_{ik}\sin\theta_{ik})}^{\equiv P_i(\mathbf{x})} - P_i = 0$$

$$\overbrace{\sum_{k=1}^{n} |V_i||V_k|(G_{ik}\sin\theta_{ik} - B_{ik}\cos\theta_{ik})}^{\equiv Q_i(\mathbf{x})} - Q_i = 0$$

$$\Rightarrow \quad \mathbf{f}(\mathbf{x}) \equiv \begin{bmatrix} P_2(\mathbf{x}) - P_2 \\ \vdots \\ P_n(\mathbf{x}) - P_n \\ Q_2(\mathbf{x}) - Q_2 \\ \vdots \\ Q_n(\mathbf{x}) - Q_n \end{bmatrix}$$

Power Mismatch

- Defined by

$$\Delta\mathbf{P}(\mathbf{x}) \equiv \begin{bmatrix} P_2 - P_2(\mathbf{x}) \\ \vdots \\ P_n - P_n(\mathbf{x}) \end{bmatrix} \quad \Delta\mathbf{Q}(\mathbf{x}) \equiv \begin{bmatrix} Q_2 - Q_2(\mathbf{x}) \\ \vdots \\ Q_n - Q_n(\mathbf{x}) \end{bmatrix}$$

- We can express f(**x**) as,

$$\mathbf{f}(\mathbf{x}) \equiv -\begin{bmatrix} \Delta\mathbf{P}(\mathbf{x}) \\ \Delta\mathbf{Q}(\mathbf{x}) \end{bmatrix} = \mathbf{0}$$

- We use power mismatch to check convergence.

Jacobian matrix

- Jacobian matrix is the gradient of the power function with respect to voltage and angle.

$$\mathbf{J} = \begin{bmatrix} \mathbf{J}_{11} & \mathbf{J}_{12} \\ \mathbf{J}_{21} & \mathbf{J}_{22} \end{bmatrix}$$

$$\mathbf{J}_{11} = \frac{\partial \mathbf{P}(\mathbf{x})}{\partial \boldsymbol{\theta}} \quad \mathbf{J}_{12} = \frac{\partial \mathbf{P}(\mathbf{x})}{\partial |\mathbf{V}|} \quad \mathbf{J}_{21} = \frac{\partial \mathbf{Q}(\mathbf{x})}{\partial \boldsymbol{\theta}} \quad \mathbf{J}_{22} = \frac{\partial \mathbf{Q}(\mathbf{x})}{\partial |\mathbf{V}|}$$

Off-diagonal Elements of Jacobian Matrix

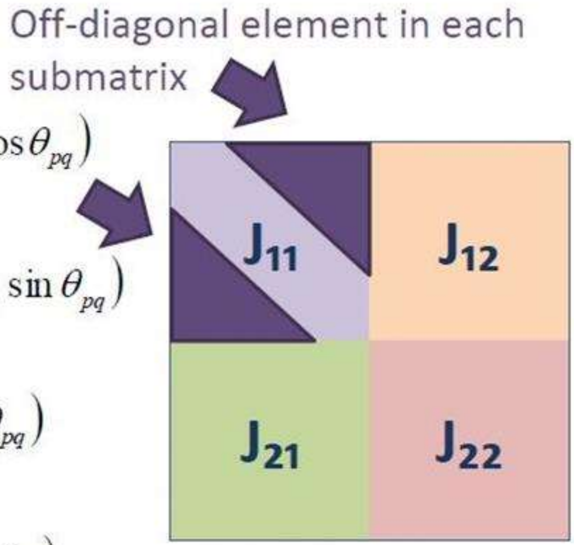
- For indices p ≠ q,

$$J_{pq}^{11} = \frac{\partial P_p(\mathbf{x})}{\partial \theta_q} = |V_p||V_q|(G_{pq}\sin\theta_{pq} - B_{pq}\cos\theta_{pq})$$

$$J_{pq}^{21} = \frac{\partial Q_p(\mathbf{x})}{\partial \theta_q} = -|V_p||V_q|(G_{pq}\cos\theta_{pq} + B_{pq}\sin\theta_{pq})$$

$$J_{pq}^{12} = \frac{\partial P_p(\mathbf{x})}{\partial |V_q|} = |V_p|(G_{pq}\cos\theta_{pq} + B_{pq}\sin\theta_{pq})$$

$$J_{pq}^{22} = \frac{\partial Q_p(\mathbf{x})}{\partial |V_q|} = |V_p|(G_{pq}\sin\theta_{pq} - B_{pq}\cos\theta_{pq})$$



Note that $J_{12} \neq J_{21}$ however, they look somewhat similar.

Diagonal Elements of Jacobian Matrix

- For indices p=q

$$J_{pp}^{11} = \frac{\partial P_p(X)}{\partial \theta_p} = \sum_{\substack{q=1 \\ \neq p}}^{n} |V_p||V_q|(B_{pq}\cos\theta_{pq} - G_{pq}\sin\theta_{pq})$$

$$J_{pp}^{21} = \frac{\partial Q_p(X)}{\partial \theta_p} = \sum_{\substack{q=1 \\ \neq p}}^{n} |V_p||V_q|(G_{pq}\cos\theta_{pq} + B_{pq}\sin\theta_{pq})$$

$$J_{pp}^{12} = \frac{\partial P_p(X)}{\partial |V_p|} = 2|V_p|G_{pp} + \sum_{\substack{q=1 \\ \neq p}}^{n} |V_q|(G_{pq}\cos\theta_{pq} + B_{pq}\sin\theta_{pq})$$

$$J_{pp}^{22} = \frac{\partial Q_p(X)}{\partial |V_p|} = -2|V_p|B_{pp} + \sum_{\substack{q=1 \\ \neq p}}^{n} |V_q|(G_{pq}\sin\theta_{pq} - B_{pq}\cos\theta_{pq})$$

Modified Diagonal Elements of Jacobian Matrix

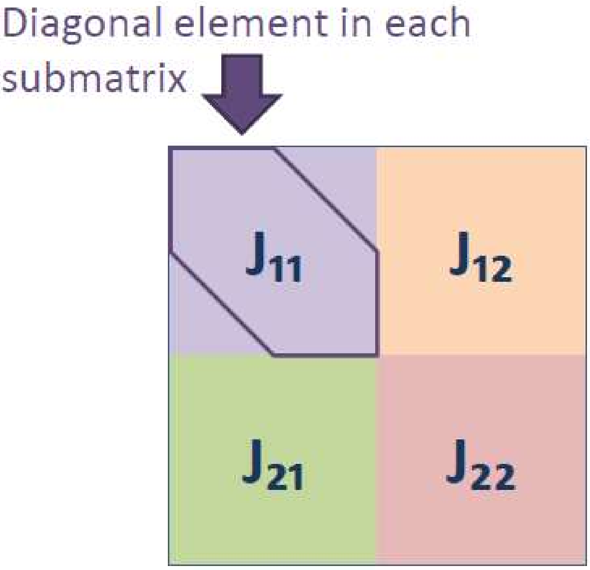
- For indices p = q,

$$J_{pp}^{11} = \frac{\partial P_p(\mathbf{x})}{\partial \theta_p} = -Q_p - B_{pp}|V_p|^2$$

$$J_{pp}^{21} = \frac{\partial Q_p(\mathbf{x})}{\partial \theta_p} = P_p - G_{pp}|V_p|^2$$

$$J_{pp}^{12} = \frac{\partial P_p(\mathbf{x})}{\partial |V_p|} = \frac{P_p}{|V_p|} + G_{pp}|V_p|$$

$$J_{pp}^{22} = \frac{\partial Q_p(\mathbf{x})}{\partial |V_p|} = \frac{Q_p}{|V_p|} - B_{pp}|V_p|$$



Note that $J_{12} \neq J_{21}$ however, they look somewhat similar.

Handling of PV_buses

- For PV-buses ‘Q’ is unspecified, so there will no equation corresponds to ΔQ, so the jacobian consists of only one row corresponds to ΔP.
- we first estimate the value of ‘Q’ for PV_bus

Using the relation

$$Q_i = \sum_{k=1}^{n} |V_i||V_k|(G_{ik} \sin\theta_{ik} - B_{ik} \cos\theta_{ik})$$

- We will proceed in the same as that of Gauss-seidel load flow.

Computational Challenges with N-R

- Large-Size of Jacobian matrix

    –For n-bus network, Jacobian matrix size may reach 2(n-1) by 2(n-1) matrix.

    –Sparse matrix.

- Need to re-evaluate and take inverse of the Jacobian matrix at every iteration.

Comparison of Load Flow Techniques

Gauss seidal method	**Newton-Raphson method**
1. Computer memory requirement is less.	1. Computer memory requirement is large, as the elements of jacobian matrix are to be computed in each iteration.
2. Time taken for each iteration is very less.	2. Time taken for each iteration is very high.
3. It takes more number of iterations.	3. It takes less number of iterations.