

Ex.No.1: FORMATION OF BUS ADMITTANCE AND BUS IMPEDANCE MATRIX

AIM

To develop a program to obtain Y_{bus} matrix for the given networks by the method of inspection.

SOFTWARE REQUIRED

MATLAB/ETAP/Power world simulator

PREREQUISITE QUESTIONS

1. Define sparsity in a matrix.
2. Recall the concept of singular matrix.
3. State the application of cofactor matrix.
4. Differentiate primitive admittance and bus admittance.
5. Define line charging admittance in a power system network

ALGORITHM

Step 1: Initialize [Y-Bus] matrix that is replace all entries by zero.

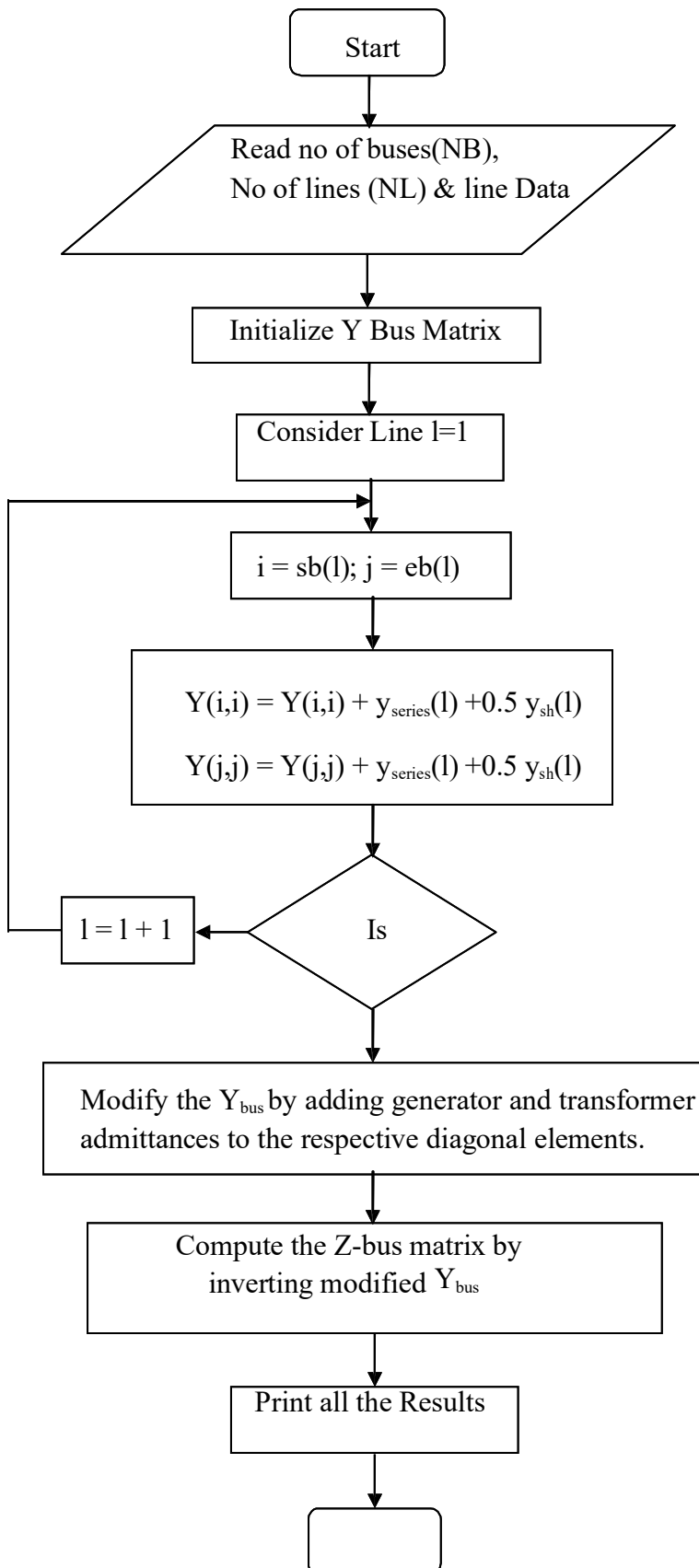
$$Y_{ij} = Y_{ji} = y_{ij} = \text{off diagonal element}$$

Step 2: Compute $Y_{ii} = \sum_{j=1}^n y_{ij} = \text{diagonal element.}$

Step 3: Modify the Y_{bus} matrix by adding the transformer and the generator admittances to the respective diagonal elements of Y bus matrix

Step 4: Compute the Z-Bus matrix by inverting the modified Y_{bus} matrix

FLOW CHART



PROBLEM STATEMENT

The [Y-Bus] matrix is formed by inspection method for a four bus system. The line data and is given below.

LINE DATA

Line Number	SB	EB	Series Impeda (p.u)
1	1	2	$0.10 + j0.40$
2	2	3	$0.15 + j0.60$
3	3	4	$0.18 + j0.50$

FORMATION OF Y-BUS BY THE METHOD OF INSPECTION**PROGRAM:**

```

clc;
clear all;

% Input number of buses and lines
n = input('Enter number of buses: ');
l = input('Enter number of lines: ');
s = input('Enter 1 for Impedance or 2 for Admittance input: ');

% Initialize matrices
ybus = zeros(n, n);
y = zeros(n, n);    % To store admittance between buses
lc = zeros(n, n);    % Line charging admittance

% Read line data
for i = 1:l
    a = input('Starting bus: ');
    b = input('Ending bus: ');
    t = input('Admittance or Impedance of line: ');
    lca = input('Line charging admittance (total for the line): ');

```

```

if s == 1
    y(a,b) = 1/t; % Convert impedance to admittance
else
    y(a,b) = t; % Admittance directly given
end
y(b,a) = y(a,b); % Symmetrical for undirected lines

lc(a,b) = lca;
lc(b,a) = lca;
end

% Construct Ybus matrix
for i = 1:n
    for j = 1:n
        if i == j
            for k = 1:n
                ybus(i,j) = ybus(i,j) + y(i,k); % Off-diagonal admittances
                if lc(i,k) ~= 0
                    ybus(i,j) = ybus(i,j) + lc(i,k)/2; % Add half line charging
                end
            end
        else
            ybus(i,j) = -y(i,j); % Off-diagonal element is negative admittance
        end
    end
end
end

% Display Ybus
disp('Ybus matrix is:');
disp(ybus);

```

FORMATION OF Z-BUS BY THE METHOD OF INSPECTION

PROGRAM:

```

clc;
clear all;

n = input('Enter number of buses: ');
l = input('Enter number of lines: ');
s = input('Enter 1 for Impedance or 2 for Admittance: ');

```

```

% Initialize matrices
y = zeros(n, n);    % Mutual admittances
lc = zeros(n, n);    % Line charging admittances
ybus = zeros(n, n); % Bus admittance matrix

% Read line data
for i = 1:l
    a = input('Starting bus: ');
    b = input('Ending bus: ');
    t = input('Admittance or Impedance of line: ');
    lca = input('Line charging admittance (total for the line): ');

    if s == 1
        y(a,b) = 1/t; % Convert impedance to admittance
    else
        y(a,b) = t;    % Use admittance directly
    end
    y(b,a) = y(a,b); % Symmetry

    lc(a,b) = lca;
    lc(b,a) = lca;    % Symmetry
end

% Construct Ybus
for i = 1:n
    for j = 1:n
        if i == j
            for k = 1:n
                ybus(i,j) = ybus(i,j) + y(i,k) + lc(i,k)/2;
            end
        else
            ybus(i,j) = -y(i,j);
        end
    end
end

% Display Ybus
disp('Ybus matrix is:');
disp(ybus);

% Calculate and display Zbus (inverse of Ybus)

```

```
zbus = inv(ybus); % Better numerically than using ybus^(-1)
disp('Zbus matrix is:');
disp(zbus);
```

OUTPUT:

VIVA QUESTIONS:

1. Differentiate primitive admittance and bus admittance in network
2. Differentiate line charging and half line charging admittance based on Ferranti effect
3. List the two applications of Y bus
4. State the applications of Y bus.
5. Indicate the difference between driving point and transfer admittance in Y bus.

STIMULATING QUESTIONS:

1. State the reason for using Z bus in short circuit studies.
2. Why Y bus is sparse and Z bus is not sparse?

RESULT: