FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRICES

Expt.No: 01
Date :

AIM:

To determine the bus admittance and impedance matrices for the given power system network.

SOFTWARE REQUIRED: MATLAB

THEORY:

FORMATION OF Y BUS MATRIX

Bus admittance is often used in power system studies. In most of the power system studies it is required to form y- bus matrix of the system by considering certain power system parameters depending upon the type of analysis.

Y-bus may be formed by inspection method only if there is no mutual coupling between the lines. Every transmission line should be represented by π- equivalent. Shunt impedances are added to diagonal element corresponding to the buses at which these are connected. The off diagonal elements are unaffected. The equivalent circuit of Tap changing transformers is included while forming Y-bus matrix.

Generalized Y-bus = $\begin{bmatrix} y_{ii} \ldots\ldots\ldots y_{id} \\ y_{di} \ldots\ldots\ldots y_{dd} \end{bmatrix}$

FORMATION OF Z BUS MATRIX:

In bus impedance matrix the elements on the main diagonal are called driving point impedance and the off-diagonal elements are called the transfer impedance of the buses or nodes. The bus impedance matrix is very useful in fault analysis.

The bus impedance matrix can be determined by two methods. In one method we can form the bus admittance matrix and then taking its inverse to get the bus impedance matrix. In another method the bus impedance matrix can be directly formed from the reactance diagram and this method requires the knowledge of the modifications of existing bus impedance matrix due to addition of new bus or addition of a new line (or impedance) between existing buses.

ALGORITHM:

Step 1: Start the Program.
Step 2: Enter the busdata Matrix in command window.
Step 3: Calculate the Formulae
Y=ybus (busdata)
Y= ybus(z)

Zbus = inv(Y)

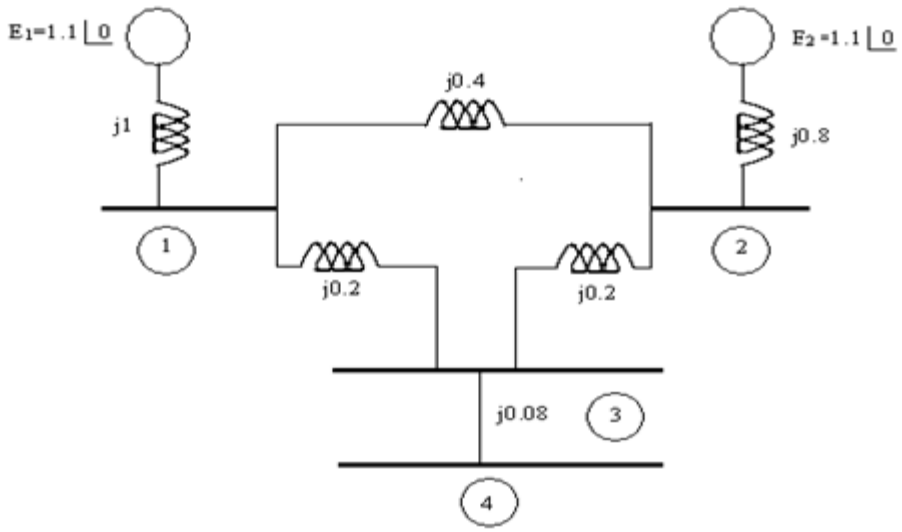
Step 4: Format the Admittance Y bus Matrix.
Step 5: Format the Impedance Z bus Matrix.
Step 6: End the Program.

PROCEDURE:

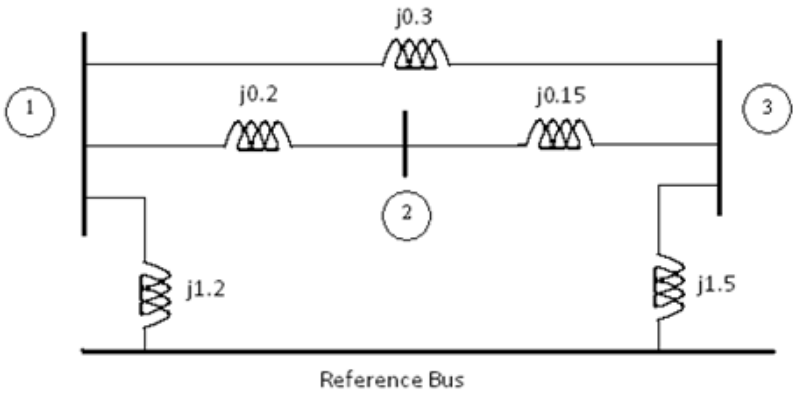
1. Enter the command window of the MATLAB.
2. Create a new M – file by selecting File - New – M – File
3. Type and save the program in the editor window.
4. Execute the program by pressing Tools – Run.
5. View the results.

EXERCISE:

(i) Determine the Y bus matrix for the power system network shown in fig.
(ii) Check the results obtained in using MATLAB.



2. (i) Determine Z bus matrix for the power system network shown in fig.
(ii) Check the results obtained using MATLAB.



Line data

From Bus	To Bus	R	X	B/2
1	2	0.10	0.20	0.02
1	4	0.05	0.20	0.02
1	5	0.08	0.30	0.03
2	3	0.05	0.25	0.03
2	4	0.05	0.10	0.01
2	5	0.10	0.30	0.02
2	6	0.07	0.20	0.025
3	5	0.12	0.26	0.025
3	6	0.02	0.10	0.01
4	5	0.20	0.40	0.04
5	6	0.10	0.30	0.03

FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRIX

```
% Program to form Admittance and Impedance Bus Formation....
clc
fprintf('FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRIX\n\n')
fprintf('Enter linedata in order of from bus,to bus,r,x,b\n\n')
linedata = input('Enter line data : ');
fb = linedata(:,1);     % From bus number...
tb = linedata(:,2);     % To bus number...
r = linedata(:,3);      % Resistance, R...
x = linedata(:,4);      % Reactance, X...
b = linedata(:,5);      % Ground Admittance, B/2...
z = r + i*x;            % Z matrix...
y = 1./z;               % To get inverse of each element...
b = i*b;                % Make B imaginary...

nbus = max(max(fb),max(tb));    % no. of buses...
nbranch = length(fb);           % no. of branches...
ybus = zeros(nbus,nbus);        % Initialise YBus...

 % Formation of the Off Diagonal Elements...
 for k=1:nbranch
    ybus(fb(k),tb(k)) = -y(k);
    ybus(tb(k),fb(k)) = ybus(fb(k),tb(k));
 end
```

```
% Formation of Diagonal Elements....
for m=1:nbus
   for n=1:nbranch
      if fb(n) == m | tb(n) == m

          ybus (m,m) = ybus(m,m) + y(n) + b(n);
        end
      end
   end
   ybus = ybus              % Bus Admittance Matrix
   zbus = inv(ybus);     % Bus Impedance Matrix
   zbus
```

Linedata =
[1,2,0.1,0.2,0.02;1,4,0.05,0.20,0.02;1,5,0.08,0.3,0.03;2,3,0.05,0.25,0.03;2,4,0.05,0.1,0.01;2,5,0.1,0.3,0.02;2,6,0.07,0.2,0.025;3,5,0.12,0.26,0.025;3,6,0.02,0.1,0.01;4,5,0.2,0.4,0.04;5,6,0.1,0.3,0.03]

OUTPUT

OUTPUT

```
FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRIX

Enter linedata in order of from bus,to bus,r,x,b

Enter line data : [1      2       0.10    0.20     0.02
             1      4       0.05    0.20     0.02
             1      5       0.08    0.30     0.03
             2      3       0.05    0.25     0.03
             2      4       0.05    0.10     0.01
             2      5       0.10    0.30     0.02
             2      6       0.07    0.20     0.025
             3      5       0.12    0.26     0.025
             3      6       0.02    0.10     0.01
             4      5       0.20    0.40     0.04
             5      6       0.10    0.30     0.03];

ybus =

   4.0063 -11.7479i  -2.0000 + 4.0000i        0            -1.1765 + 4.7059i  -0.8299 + 3.1120i        0
  -2.0000 + 4.0000i   9.3283 -23.1955i  -0.7692 + 3.8462i  -4.0000 + 8.0000i  -1.0000 + 3.0000i  -1.5590 + 4.4543i
        0            -0.7692 + 3.8462i   4.1557 -16.5673i        0            -1.4634 + 3.1707i  -1.9231 + 9.6154i
  -1.1765 + 4.7059i  -4.0000 + 8.0000i        0             6.1765 -14.6359i  -1.0000 + 2.0000i        0
  -0.8299 + 3.1120i  -1.0000 + 3.0000i  -1.4634 + 3.1707i  -1.0000 + 2.0000i   5.2933 -14.1378i  -1.0000 + 3.0000i
        0            -1.5590 + 4.4543i  -1.9231 + 9.6154i        0            -1.0000 + 3.0000i   4.4821 -17.0047i


zbus =

   0.0225 - 1.8585i  -0.0028 - 1.9250i  -0.0081 - 1.9459i   0.0046 - 1.9155i  -0.0038 - 1.9363i  -0.0083 - 1.9454i
  -0.0028 - 1.9250i   0.0099 - 1.8962i  -0.0004 - 1.9310i  -0.0002 - 1.9180i  -0.0051 - 1.9376i  -0.0010 - 1.9296i
  -0.0081 - 1.9459i  -0.0004 - 1.9310i   0.0177 - 1.8654i  -0.0073 - 1.9431i  -0.0044 - 1.9319i   0.0093 - 1.9022i
   0.0046 - 1.9155i  -0.0002 - 1.9180i  -0.0073 - 1.9431i   0.0219 - 1.8702i  -0.0060 - 1.9384i  -0.0076 - 1.9423i
  -0.0038 - 1.9363i  -0.0051 - 1.9376i  -0.0044 - 1.9319i  -0.0060 - 1.9384i   0.0121 - 1.8905i  -0.0038 - 1.9327i
```

RESULT:

Thus the bus Impedance and admittance matrix for the given system were determined and verified using MATLAB.