**Exercise – 5.2**

Assume that you are provided with the bus impedance matrix for the existing power system network with ‘N’ buses. If a new branch is to be added **between two existing buses**, write a MATLAB m-code to build the Zbus matrix of the modified network.

**M-code:**

% Ex-5.2 (Power Systems)

% Sambhav R Jain

% 107108103

clc;

clear all;

close all;

fprintf('Ex-5.2 Zbus building algorithm\n');

fprintf(' - Sambhav R Jain (107108103)\n\n');

N = input('Enter the number of buses in the existing power system: ');

for m = 1:1:N

for n = m:1:N

Z(m,n) = input(sprintf('Enter the z(%d,%d): ',m,n));

Z(n,m) = Z(m,n);

end

end

fprintf('\nThe Zbus matrix is: \n');

Zold = 1i\*Z

j = input('Enter the bus subscript "j" where the new branch is to be added: ');

k = input('Enter the bus subscript "k" where the new branch is to be added: ');

Zb = input(sprintf('Enter the impedance to be added between bus %d and %d: ',j,k));

for p = 1:1:N

Z(N+1,p) = Z(k,p) - Z(j,p);

end

for q = 1:1:N

Z(q,N+1) = Z(q,k) - Z(q,j);

end

Z(N+1,N+1) = Z(k,k) + Z(j,j) -2\*Z(k,j) + Zb;

Zeq = Z(N+1,N+1);

% Kron reduction

for m = 1:1:N

for n = 1:1:N

Z(m,n) = Z(m,n) - (Z(N+1,n)\*Z(m,N+1)/Zeq);

end

end

% To eliminate the (N+1)th row and column

for m = 1:1:N

for n = 1:1:N

Znew(m,n) = Z(m,n);

end

end

fprintf('\nThe new Zbus matrix is: \n');

Znew = 1i\*Znew

**Terminal Display:**

Ex-5.2 Zbus building algorithm

- Sambhav R Jain (107108103)

Enter the number of buses in the existing power system: 3

Enter the z(1,1): 0.42

Enter the z(1,2): 0.28

Enter the z(1,3): 0.38

Enter the z(2,2): 0.52

Enter the z(2,3): 0.26

Enter the z(3,3): 0.53

The Zbus matrix is:

Zold =

0 + 0.4200i 0 + 0.2800i 0 + 0.3800i

0 + 0.2800i 0 + 0.5200i 0 + 0.2600i

0 + 0.3800i 0 + 0.2600i 0 + 0.5300i

Enter the bus subscript "j" where the new branch is to be added: 2

Enter the bus subscript "k" where the new branch is to be added: 3

Enter the impedance to be added between bus 2 and 3: 0.4

The new Zbus matrix is:

Znew =

0 + 0.4092i 0 + 0.3080i 0 + 0.3510i

0 + 0.3080i 0 + 0.4473i 0 + 0.3355i

0 + 0.3510i 0 + 0.3355i 0 + 0.4516i

**Results:**

Hence a MATLAB m-code is written to compute the new Zbus matrix after adding a new branch between two existing buses in a power system network.