

MATLAB

MATRICES

1. Rank of the matrices or to check the consistency of the system of equations.

Code: $\Rightarrow A = \begin{bmatrix} 2 & 1 & 4 \\ 4 & 11 & -1 \\ 8 & -3 & 2 \end{bmatrix}$

A =
2 1 4
4 11 -1
8 -3 2

$\Rightarrow B = \begin{bmatrix} 12 \\ 33 \\ 20 \end{bmatrix}$

B =
12
33
20

$\Rightarrow \text{rank}([A, B]) == \text{rank}(A)$

ans =

1

2) LU decomposition method:-

$$\gg a = \begin{bmatrix} 20 & 1 & -2 \\ 3 & 20 & -1 \\ 2 & -3 & 20 \end{bmatrix};$$

$$\gg b = \begin{bmatrix} 17 \\ -18 \\ 25 \end{bmatrix};$$

$$\gg [L, u] = \text{lu}(a);$$

$$\gg y = \text{linsolve}(L, b);$$

$$\gg x = \text{linsolve}(u, y);$$

$$x = \begin{bmatrix} 1.0000 \\ -1.0000 \\ 1.0000 \end{bmatrix}$$

3) Find the lower & upper triangular matrices (Modal matrix)

$$\gg A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 1 & 2 & 3 \end{bmatrix};$$

$$\gg [L, U, P] = \text{lu}(A)$$

$$L = \begin{bmatrix} 1.0000 & 0 & 0 \\ 0.5000 & 1.0000 & 0 \\ 0.5000 & 1.0000 & 1.0000 \end{bmatrix}$$

$$U = \begin{bmatrix} 2.0000 & 3.0000 & 4.0000 \\ 0 & 0.5000 & 1.0000 \\ 0 & 0 & 0 \end{bmatrix}$$

$$P = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

4) Gauss Seidel iteration method.

$$\gg A = \begin{bmatrix} 5 & -1 & 1 \\ 2 & 4 & 0 \\ 1 & 1 & 5 \end{bmatrix}$$

$$A = \begin{array}{ccc} 5 & -1 & 1 \\ 2 & 4 & 0 \\ 1 & 1 & 5 \end{array}$$

$$\gg B = \begin{bmatrix} 10 \\ 12 \\ -1 \end{bmatrix}$$

$$B = \begin{array}{c} 10 \\ 12 \\ -1 \end{array}$$

$$\gg f1 = @(x,y,z) (10+y-z)/5 ;$$

$$\gg f2 = @(x,y,z) (12-2*x)/4 ;$$

$$\gg f3 = @(x,y,z) (-1-x-y)/5 ;$$

$$\gg x = 2 ;$$

$$\gg y = 2 ;$$

$$\gg z = -1 ;$$

$\gg$

$\gg$ for i=1:3

$f1(x,y,z);$

$f2(x,y,z);$

$f3(x,y,z);$

$x = f1(x,y,z);$

$y = f2(x,y,z);$

$z = f3(x,y,z);$

end

$\gg x$

$$x = 2.5558$$

>> y

$$y = 1.7221$$

>> z

$$z = -1.0556.$$

5> To find Eigen values and eigen vectors.

$$\gg A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & -2 & 3 \\ 2 & -1 & 3 \end{bmatrix};$$

A =

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & -2 & 3 \\ 2 & -1 & 3 \end{bmatrix}$$

$$\gg [\text{Evec Ev}] = \text{eig}(A)$$

Evec =

$$\begin{bmatrix} -0.8934 & 0.2132 & -0.0778 \\ 0.0490 & 0.9712 & 0.6228 \\ -0.4467 & 0.1066 & 0.7785 \end{bmatrix}$$

Ev =

$$\begin{bmatrix} 7.1098 & 0 & 0 \\ 0 & -2.1098 & 0 \\ 0 & 0 & 2.0000 \end{bmatrix}$$

6) To calculate/find ~~Modal matrix~~ and diagonalization of matrix.

$$\gg a = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix};$$

$$\gg [v, d] = \text{eig}(a)$$

$$v = \begin{bmatrix} -0.7071 & 0.5774 & 0.4082 \\ 0 & -0.5774 & 0.8165 \\ 0.7071 & 0.5774 & 0.4082 \end{bmatrix}$$

$$d = \begin{bmatrix} -2.0000 & 0 & 0 \\ 0 & 3.0000 & 0 \\ 0 & 0 & 6.0000 \end{bmatrix}$$

7) Guass elimination method

$$\gg \text{aug} = \begin{bmatrix} 1 & 1 & 1 & 9 \\ 1 & -2 & 3 & 8 \\ 2 & 1 & -1 & 3 \end{bmatrix}$$

$$\gg \text{aug} = \text{rref}(\text{aug});$$

$$\gg a = \text{aug}(:, 1 : \text{length}(\text{aug}) - 1);$$

$$\gg b = \text{aug}(:, \text{length}(\text{aug}));$$

$$\gg x = \text{linsolve}(a, b)$$

$$x = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$$

8) Echelon form

>> A = [1 3 4 3 ; 3 9 12 3 ; 1 3 4 1];

>> Echelon_Form = rref(A)

Echelon_Form =

$$\begin{bmatrix} 1 & 3 & 4 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

9) Find the inverse of a matrix $[A^{-1}]$

>> X = [1 0 2 ; -1 5 0 ; 0 3 -9]

>> inv(X);