

DATE / /

OM OF OW OF OF OS OS

NOTES

$$A = \begin{bmatrix} 4 & 8 & -1 & -2 \\ -2 & -9 & -2 & -4 \\ 0 & 10 & 5 & -10 \\ 1 & -13 & -14 & -13 \end{bmatrix}$$

$$\det(A - \tau I) = 0$$

$$A - \tau I = \begin{bmatrix} 4-\tau & 8 & -1 & -2 \\ -2 & -9-\tau & -2 & -4 \\ -2 & 10 & 5-\tau & -10 \\ 1 & -13 & -14 & -13-\tau \end{bmatrix}$$

$$\det(A - \tau I) = 0$$

$$4\tau^4 + 13\tau^3 - 219\tau^2 - 835\tau + 3500 = 0$$

Use Newton Raphson method

$$\tau_{n+1} = \tau_n - \frac{f(\tau_n)}{f'(\tau_n)}$$

$$\rightarrow f(\tau) = \tau^4 + 13\tau^3 - 219\tau^2 - 835\tau + 3500$$

$$\Rightarrow f'(\tau) = 4\tau^3 + 39\tau^2 - 438\tau - 835$$

$$\tau(4\tau^3 + 39\tau^2 - 438\tau - 835) - (\tau^4 + 13\tau^3 - 219\tau^2 - 835\tau + 3500)$$

$$4\tau^3 + 39\tau^2 - 438\tau - 835$$

$$\begin{aligned} & 3T^4 + 59T^3 - 438T^2 - 835T - T^4 - 13T^2 + 219T^2 + 835T \\ & 4T^3 + 39T^2 - 438T - 835 \end{aligned}$$

$$\frac{3T^4 + 26T^3 - 219T^2 - 3500}{4T^3 + 39T^2 - 438T - 835} = T_{n+1}$$

$$T_0 = 2 \text{ (divisible by 3500)}$$

$$\frac{3(2)^4 + 26(2)^3 - 219(2)^2 - 3500}{4(2)^3 + 39(2)^2 - 438(2) - 835}$$

$$T_3 = 2.675$$

the eigen value: $T_3 = 2.675$

Calculation of the eigen vectors for $T_1 = 2.675$

$$T_1 = 2.675$$

$$A - T_1 \cdot I = \begin{pmatrix} 1.325 & 8 & -1 & -2 \\ -2 & -11.675 & -2 & -4 \\ 0 & 10 & 2.325 & -10 \\ -1 & -13 & -14 & -15.675 \end{pmatrix}$$

$$Ax = \lambda x \quad Av = Tv$$

$$(A - T_1) \cdot \vec{v} = \vec{0}$$

Augmented matrix

$$A = \left[\begin{array}{cccc|c} 1.325 & 8 & -1 & -2 & 0 \\ -2 & -11.675 & -2 & -4 & 0 \\ 0 & 10 & 2.325 & -10 & 0 \\ -1 & -13 & -14 & -15.675 & 0 \end{array} \right] \times (0.754)$$

Gaussian Elimination

$$R_1 / 1.325 \Rightarrow R_1 \left[\begin{array}{cccc|c} 1 & 6.038 & -0.755 & -1.509 & 0 \\ -2 & -11.675 & -2 & -4 & 0 \\ 0 & 10 & 2.325 & -10 & 0 \\ -1 & -13 & -14 & -15.675 & 0 \end{array} \right] \times 2$$

$$R_2 - (-2) \cdot R_1 = R_2$$

$$A = \left[\begin{array}{cccc|c} 1 & 6.038 & -0.755 & -1.509 & 0 \\ 0 & 0.397 & -3.509 & -7.018 & 0 \\ 0 & 10 & 2.325 & -10 & 0 \\ -1 & -13 & -14 & -15.675 & 0 \end{array} \right] \times 1$$

$$R_4 - (-1) \cdot R_1 \Rightarrow \left[\begin{array}{cccc|c} 1 & 6.036 & -0.754 & -1.509 & 0 \\ 0 & 0.397 & -3.509 & -7.018 & 0 \\ 0 & 10 & 2.325 & -10 & 0 \\ 0 & -6.964 & -14.754 & -17.184 & 0 \end{array} \right] \times 2.54$$

$$R_2 / 0.397 = R_2 \rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & -8.834 & -17.669 \\ 0 & 10 & 2.325 & -10 \\ 0 & -6.964 & -14.754 & -17.184 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times$$

$$R_3 = R_3 - 10 R_2 \rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & -8.834 & -17.669 \\ 0 & 0 & 90.669 & 166.688 \\ 0 & -6.964 & -14.754 & -17.184 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times$$

$$R_4 = R_4 - (-6.964) \cdot R_2 \rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & -8.834 & -17.669 \\ 0 & 0 & 90.669 & 166.688 \\ 0 & 0 & -76.278 & -140.231 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times$$

$$R_3 / 90.669 \Rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & -8.834 & -17.669 \\ 0 & 0 & 1 & 1.838 \\ 0 & 0 & -76.278 & -140.231 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times$$

$$R_4 = R_4 - (-76.278) \cdot R_3 \Rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & -8.834 & -17.669 \\ 0 & 0 & 1 & 1.838 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times$$

$$R_2 = R_2 - (-8.834) \cdot R_3 \Rightarrow \begin{bmatrix} 1 & 6.036 & -0.754 & -1.509 \\ 0 & 1 & 0 & -1.428 \\ 0 & 0 & 1 & 1.838 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \times (0.754)$$

$$R_1 + R_1 - (0.754)R_3 \Rightarrow \begin{bmatrix} 1 & 6.036 & 0 & -0.122 & 0 \\ 0 & 1 & 0 & -1.422 & 0 \\ 0 & 0 & 0 & 1.238 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{matrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{matrix}$$

$$R_1 - 6.036R_2 \Rightarrow \begin{bmatrix} 1 & 0 & 0 & 8.494 & 0 \\ 0 & 1 & 0 & -1.422 & 0 \\ 0 & 0 & 1 & 1.238 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{cases} x_1 \\ x_2 \\ x_3 \\ x_4 \end{cases}$$

$$+ 8.494x_4 = 0$$

$$- 1.422x_4 = 0$$

$$+ 1.238x_4 = 0$$

$$x_3 = -1.238x_4$$

$$x_2 = -1.422x_4$$

$$x_1 = -8.494x_4$$

$$\text{Then, } x_1 = -8.494x_4$$

$$x_2 = -1.422x_4$$

$$x_3 = -1.238x_4$$

$$x = \begin{pmatrix} -8.494x_4 \\ -1.422x_4 \\ -1.238x_4 \\ x_4 \end{pmatrix}$$

DATE / / OM OM OM OM OM OM OM OM NOTES

$$\begin{array}{r} 14 \left(\begin{array}{r} - 8.494 \\ 1.428 \\ - 1.238 \\ \hline \end{array} \right. \end{array}$$

$$14 \times 1 = 14$$

$$\begin{array}{r} 14 \times 1 = 14 \quad \sqrt{3} = \begin{array}{r} - 8.494 \\ 1.428 \\ - 1.238 \\ \hline \end{array} \end{array}$$