

The set of models of a system in eqn (1) with the aid of MATHEMATICS estimate the values of the  $x_3$  in the model eqn.

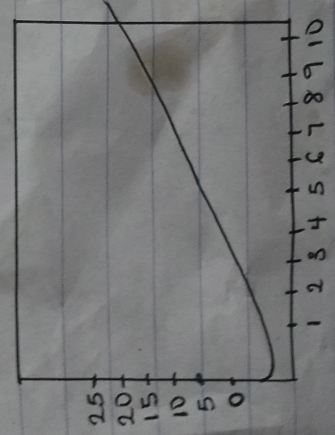
$$\begin{bmatrix} x_1 - 2x_2 - x_3 + 3x_4 = 10 \\ 2x_1 + 3x_2 + 4x_3 - 2x_4 = 8 \\ -x_2 + 3x_3 + 2x_4 = 7 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & -2 & -1 & 3 \\ 2 & 3 & 0 & 1 \\ 0 & -1 & 3 & 1 \end{bmatrix}$$

$$C = \begin{bmatrix} 10 \\ 8 \\ 5 \\ -7 \end{bmatrix}$$

$$D = \begin{bmatrix} 0.0267 & 0.2400 & 0.4933 & 0.6667 \\ -0.0733 & 0.1600 & -0.2267 & -0.3333 \\ -0.1067 & 0.0400 & 0.0267 & 0.3333 \\ 0.2267 & 0.0400 & -0.3067 & -0.3333 \end{bmatrix}$$

$$E = \begin{bmatrix} -1.0000 \\ 2.0000 \\ -3.0000 \\ 4.0000 \end{bmatrix}$$



The model equation  $y = \sin(0.25t) + 2t + \cos(0.85t) + 2t + 2^{-0.85t} - 2 \cos \frac{t}{10}$

$0 \leq t \leq 10$  hrs,  $\Delta t = 0.1$  hr  
 $t = 0:0.1:10$

$y = \sin(0.25 * t) + 2 * t + \exp(0.85 * t) - 2 * \cos(t/10)$ , Plot

grid rows  
grid on

[t\y]	1.4000	1.6375
0-1.0000	1.5000	1.8687
0-1.0000	1.5000	2.0735
0-2.0000	1.6800	2.8285
0-2.0000	1.7000	2.5028
0-3.0000	1.8000	2.3021
0-4.0000	1.9000	3.0441
0-5.0000	2.0000	3.2857
0-6.0000	2.1000	3.5358
0-7.0000	2.2000	3.7852
0-8.0000	2.3000	4.0367
0-9.0000	2.4000	4.2903
0-10.0000	2.5000	4.5458
0-1.0000	2.6000	4.8030
0-2.0000	2.7000	5.0619
0-3.0000	2.8000	5.3216
0-4.0000	2.9000	5.5820
0-5.0000	3.0000	5.8442
0-6.0000	3.1000	6.1080
0-7.0000	3.2000	6.3735
0-8.0000	3.3000	6.6405
0-9.0000	3.4000	6.9090
0-10.0000	3.5000	7.1790
0-1.0000	3.6000	7.4507
0-2.0000	3.7000	7.7242
0-3.0000	3.8000	8.0000
0-4.0000	3.9000	8.2780
0-5.0000	4.0000	8.5580
0-6.0000	4.1000	8.8400
0-7.0000	4.2000	9.1240
0-8.0000	4.3000	9.4100
0-9.0000	4.4000	9.6980
0-10.0000	4.5000	9.9880
0-1.0000	4.6000	10.2800
0-2.0000	4.7000	10.5740
0-3.0000	4.8000	10.8700
0-4.0000	4.9000	11.1680
0-5.0000	5.0000	11.4680
0-6.0000	5.1000	11.7700
0-7.0000	5.2000	12.0740
0-8.0000	5.3000	12.3800
0-9.0000	5.4000	12.6880
0-10.0000	5.5000	13.0000
0-1.0000	5.6000	13.3140
0-2.0000	5.7000	13.6300
0-3.0000	5.8000	13.9480
0-4.0000	5.9000	14.2680
0-5.0000	6.0000	14.5900
0-6.0000	6.1000	14.9140
0-7.0000	6.2000	15.2400
0-8.0000	6.3000	15.5680
0-9.0000	6.4000	15.8980
0-10.0000	6.5000	16.2300
0-1.0000	6.6000	16.5640
0-2.0000	6.7000	16.9000
0-3.0000	6.8000	17.2380
0-4.0000	6.9000	17.5780
0-5.0000	7.0000	17.9200
0-6.0000	7.1000	18.2640
0-7.0000	7.2000	18.6100
0-8.0000	7.3000	18.9580
0-9.0000	7.4000	19.3080
0-10.0000	7.5000	19.6600
0-1.0000	7.6000	20.0140
0-2.0000	7.7000	20.3700
0-3.0000	7.8000	20.7280
0-4.0000	7.9000	21.0880
0-5.0000	8.0000	21.4500
0-6.0000	8.1000	21.8140
0-7.0000	8.2000	22.1800
0-8.0000	8.3000	22.5480
0-9.0000	8.4000	22.9180
0-10.0000	8.5000	23.2900

1  $(x_2 - 2x_2 - x_3 + 3x_2) = 10$

$2x + 3x_2 + x_4 = 8$

$x_2 - 4x_3 - 2x_2 = 3$

$-x_2 + 3x_3 + x_2 = -7$

$$M = \begin{pmatrix} 1 & -2 & -1 & 3 \\ 2 & 3 & 0 & 1 \\ 1 & 0 & -1 & -2 \\ 0 & -1 & 3 & 1 \end{pmatrix}$$

$$B = \begin{pmatrix} 10 \\ 8 \\ 3 \\ -7 \end{pmatrix}$$

soln := **isolve**(M,B)

$$\text{soln} = \begin{pmatrix} -1 \\ 2 \\ -3 \\ 4 \end{pmatrix}$$

2  $y = \sin(0.25t) + 2t + e^{-0.85t} - 2 \cos\left(\frac{\pi}{10}\right)t$

evaluation over the complex plane yields

$$y = \sin(0.25t) + 2t + \exp(-0.85 \cdot \exp(1)) - 2 \cos\left(\frac{\pi}{10}\right)t$$

by factoring, yields

$$y = \sin\left(\frac{1}{4} \cdot t\right) + 2 \cdot t + \exp\left(\frac{-17}{20} \cdot \exp(1)\right) - \frac{1}{2} \cdot \sqrt{2} \cdot (5 + \sqrt{5}) \left(\frac{1}{2}\right) \cdot t$$

$0 \leq t \leq 10 \quad \Delta t = 0.1$

expands to

$0 \leq t \leq 10$

$$y = \sin(0.25t) + 2t + e^{-0.85t} - 2 \cos\left(\frac{\pi}{10}\right)t$$

$$y = \sin(0.25t) + 2t + e^{-0.85t} - 2 \cos\left(\frac{\pi}{10}\right)t$$

