Introduction to Matlab

Not required for final examination

what is Matlab?

Matlab — stands for matrix laboratory

MATLAB is a software or a high-performance language for technical computing, developed by MathWorks Ltd. in USA.

Control toolbox in Matlab:

General Data extraction. Conversions. Model dynamics. Time-domain analysis LQR/LQG design. Time delays. Overloaded arithmetic operations. Matrix equation solvers.	Creating linear models. System interconnections. Frequency-domain analysis. Classical design. Pole placement. State-space models. Model dimensions and characteristics. Demonstrations.

Models of control systems in Matlab

$$a_n \frac{d^n c(t)}{dt^n} + a_{n-1} \frac{d^{n-1} c(t)}{dt^{n-1}} + \mathbf{L} + a_1 \frac{dc(t)}{dt} + a_0 c(t)$$
$$= b_m \frac{d^m r(t)}{dt^m} + b_{m-1} \frac{d^{m-1} r(t)}{dt^{m-1}} + \mathbf{L} + b_1 \frac{dr(t)}{dt} + b_0 r(t)$$

$$\frac{C(s)}{R(s)} = \frac{b_m s^m + b_{m-1} s^{m-1} + \mathbf{L} + b_1 s + b_0}{a_n + a_{n-1} s^{n-1} + \mathbf{L} + a_1 s + a_0} = G(s)$$

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num = [b_m, b_{m-1}, …,b_1, b_0]

den = [a_n, a_{n-1}, …,a_1, a_0]

sys = tf [num, den]

Ex

$$\frac{C(s)}{R(s)} = \frac{6s^3 + 12s^2 + \mathbf{L} + 6s + 10}{s^4 + 2s^3 + 3s^2 + s + 1} = G(s)$$

num = [6, 12, 6, 10]

den = [1 2 3 1 1]

sys = tf (num, den)

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Transfer function:
 6 s^3 + 12 s^2 + 6 s + 10
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s^4 + 2 s^3 + 3 s^2 + s + 1
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Input of vector , summation of two vectors

Input of matrix, summation of two matrices

$$c = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} + \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$$

$$c = \begin{bmatrix} 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 2 \\ 4 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$$