Model Documentation of the 'Flexible actuator'

1 Nomenclature

1.1 Nomenclature for Model Equations

- x state vector
- u control input vector
- w noise vector
- z regulated output vector
- y measurement vector

2 Model Equations

State Vector and Input Vector:

$$x \in \mathbb{R}^5 u$$
 $\in \mathbb{R}^2 w \in \mathbb{R}^1 z$ $\in \mathbb{R}^3 y \in \mathbb{R}^3$

System Equations:

$$\dot{x}(t) = Ax(t) + B_1 w(t) + Bu(t) \tag{1a}$$

$$z(t) = C_1 x(t) + D_{11} w(t) + D_{12} u(t)$$
(1b)

$$y(t) = Cx(t) + D21w(t)$$
(1c)

Outputs: z

2.1 Exemplary parameter values

$A = \begin{bmatrix} 0 & 1.0 & 0 & 0 & 0 \\ -1.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.02 & 0 \\ 0.2 & 0 & 0 & 0 & 0 \\ 0.2 & 0 & 0 & 0 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix}$ $B_1 = \begin{bmatrix} 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \\ 0 & 0 & 0.1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ $C_1 = \begin{bmatrix} 0 & 1.0 & 0 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$\begin{bmatrix} A & \begin{bmatrix} 0 & 0 & 0 & 1.02 & 0 \\ 0.2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\ B & \begin{bmatrix} 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix} \\ B_1 & \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix} \\ C_1 & \begin{bmatrix} 0.1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$\begin{bmatrix} A & \begin{bmatrix} 0 & 0 & 0 & 1.02 & 0 \\ 0.2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\ B & \begin{bmatrix} 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix} \\ B_1 & \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix} \\ C_1 & \begin{bmatrix} 0.1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$B = \begin{bmatrix} 0.2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0$
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$B = \begin{bmatrix} 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix}$ $C_1 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0.1 \\ 0 & 0 & 0.1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$
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$B_1 = \begin{bmatrix} 0 & 1.0 \\ 1.0 & 0 \\ 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix}$ $C_1 = \begin{bmatrix} 0.1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$B_1 = \begin{bmatrix} 1.0 & 0 \\ 0 & 0 \\ 0 & -0.2 \\ 0 & 0 \\ 0 & 1.0 \\ 1.0 & 0 \end{bmatrix}$ $C_1 = \begin{bmatrix} 0.1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
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$C_1 = egin{bmatrix} 0 & 1.0 \ 1.0 & 0 \end{bmatrix} \ 0.1 & 0 & 0 & 0 \ 0 & 0 & 0.1 & 0 & 0 \ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$C_1 = egin{bmatrix} 0.1 & 0 & 0 & 0 & 0 \ 0 & 0 & 0.1 & 0 & 0 \ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$egin{array}{ccccc} C_1 & & 0 & 0 & 0.1 & 0 & 0 \ 0 & 0 & 0 & 0 & 0 \ \end{array}$
$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
$\begin{bmatrix} 0 & 0 & 0 & 0 & 1.0 \end{bmatrix}$
$C = \begin{bmatrix} 1.0 & 0 & 0 & 0 \end{bmatrix}$
0 0 1.0 0 0
[0]
$D_{11} 0 $
[0]
[0 0]
$D_{12} = \begin{bmatrix} 0 & 0 \end{bmatrix}$
$\begin{bmatrix} 0 & 0.2 \end{bmatrix}$
[0]
D_{21} 0
$\lfloor 0 \rfloor$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and was automatically imported into ACKREP.

The original description was:

ROC7 Flexible actuator B. Fares, P. Apkarian and D. Noll, "An Augmented Lagrangian Method for a Class of LMI-Constrained Problems in Robust Control Theory", IJOC, Vol. 74, Nr. 4, pp. 348-360 nc=1

4 Simulation

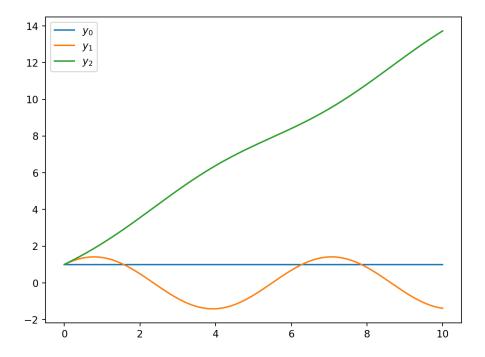


Figure 1: Simulation of the Flexible actuator.

References

[1] . Fares, P. Apkarian and D. Noll, "An Augmented Lagrangian Method for a Class of LMI-Constrained Problems in Robust Control Theory", IJOC, Vol. 74, Nr. 4, pp. 348-360 nc=1