Model Documentation of the 'Plate Experiment for the active vibration damping of large flexible space structures, example of order 10'

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:

$$x \in \mathbb{R}^1 0u \qquad \in \mathbb{R}^2 w \in \mathbb{R}^2 z \qquad \in \mathbb{R}^2 y \in \mathbb{R}^2$$

System Equations:

$$\dot{x}(t) = Ax(t) + B_1 w(t) + Bu(t) \tag{1a}$$
$$z(t) = C_1 x(t) + D_{11} w(t) + D12u(t) \tag{1b}$$
$$y(t) = Cx(t) + D21w(t) \tag{1c}$$

Outputs: z

2.1 Exemplary parameter values

Symbol	Value
A	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -8.4268 & 0 & 9.6557 & 0 & -5.083 & -0.0253 & 0 & 0.0155 \\ 0 & -20.2022 & 0 & 20.0736 & 0 & 0 & -0.0244 & 0 \\ -23.9425 & 0 & -10.7354 & 0 & -147.0685 & -0.0049 & 0 & -0.0359 \\ 0 & 126.1547 & 0 & -132.8028 & 0 & 0 & 0.0947 & 0 \\ -39.905 & 0 & 6.607 & 0 & -188.4411 & -0.0247 & 0 & 0.0016 \end{bmatrix}$
B	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ -0.001 & -0.001 \\ -0.0133 & 0.0133 \\ 0.048 & 0.048 \\ -0.0516 & 0.0516 \\ 0.0213 & 0.0213 \end{bmatrix}$
B_1	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ -0.001 & -0.001 \\ -0.0133 & 0.0133 \\ 0.048 & 0.048 \\ -0.0516 & 0.0516 \\ 0.0213 & 0.0213 \end{bmatrix}$
C_1	$\begin{bmatrix} 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -0.8084 & 0 & 0.7509 & 0 & -0.9501 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
C	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0.0115 & -0.0536 & 0.9713 & -0.2009 & -0.5746 \\ 0 & 0 & 0 & 0 & 0 & 0.0115 & 0.0536 & 0.9713 & 0.2009 & -0.5746 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 1.0 & 0 \\ 0 & 1.0 \end{bmatrix}$
D_{21}	$\begin{bmatrix} 0 & 0 \\ 0.0972 & 0.7509 \end{bmatrix}$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and wasautomatically imported into ACKREP.
The original description was:

DLR1 Plate Experiment for the active vibration damping of large flexible space structures, example of order 10 J. Bals, "Aktive Schwingungsdaempfung flexibler Strukturen", Universitaet Karlsruhe, Fakultaet fuer Elektrotechnik, Germany, 1989 reduced system

4 Simulation

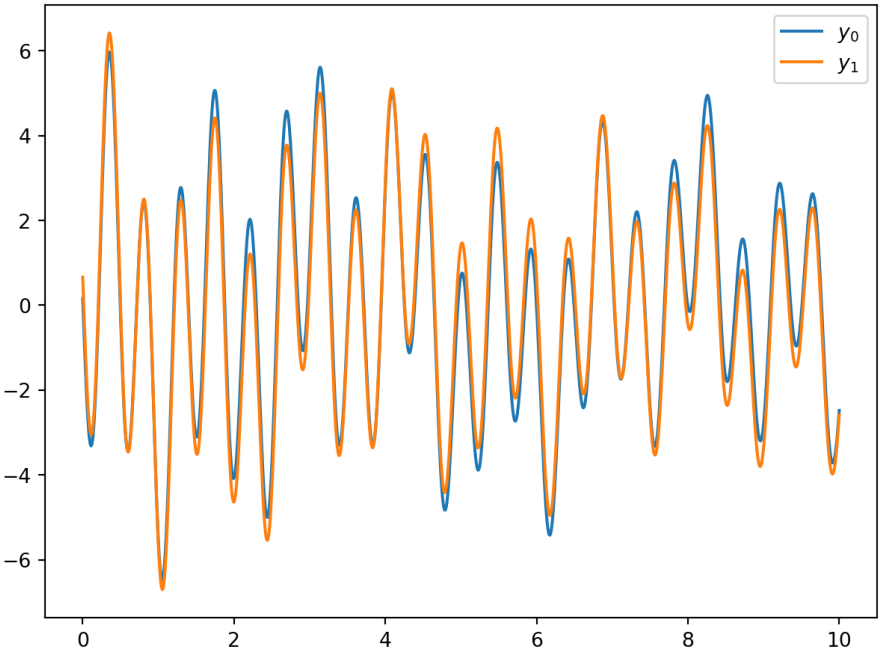

Figure 1: Simulation of the Plate Experiment for the active vibration damping of large flexible space structures, example of order 10.

References

[1] . Bals, "Aktive Schwingungsdaempfung flexibler Strukturen", Universitaet Karlsruhe, Fakultaet fuer Elektrotechnik, Germany, 1989 reduced system