Model Documentation of the 'Decentralized Interconnected System'

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:

$$x \in \mathbb{R}^8 u \qquad \in \mathbb{R}^4 w \in \mathbb{R}^1 z \qquad \in \mathbb{R}^8 y \in \mathbb{R}^4$$

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	$\begin{bmatrix} 0.144 & -0.058 & 0.056 & 0.042 & 0.12 & 2.1454 & 0 & 0.08 \\ -0.506 & -0.236 & -0.02 & -0.012 & -0.06 & -0.909 & 1.093 & -0.04 \\ 0 & 0 & -0.278 & 0.291 & 0 & 0 & 0 & 0.58 \\ 0 & 0 & 0 & -0.33 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.303 & 0.029 & -1.67 & 0 & 0 & 0.092 \\ -0.154 & 0.133 & -0.006 & -0.004 & -0.014 & -1.688 & 0.236 & 0.013 \\ -0.345 & 0.304 & -0.018 & -0.014 & -0.032 & -0.611 & -1.824 & -0.024 \\ 0 & 0 & 0 & 0.247 & 0 & 0 & 0 & -1.978 \end{bmatrix}$
B	$\begin{bmatrix} -0.076 & 0.02 & 0 & 0 \\ 0.588 & -0.006 & 0 & 0 \\ 0 & 0.152 & 0 & 0 \\ 0 & 1.45 & 0 & 0 \\ 0 & 0 & 0 & 0.012 \\ 0 & 0 & 0.162 & -0.002 \\ 0 & 0 & 0.414 & -0.008 \\ 0 & 0 & 0 & 0.248 \end{bmatrix}$
B_1	$\begin{bmatrix} -0.076 & 0.02 & 0 & 0 \\ 0.588 & -0.006 & 0 & 0 \\ 0 & 0.152 & 0 & 0 \\ 0 & 1.45 & 0 & 0 \\ 0 & 0 & 0 & 0.012 \\ 0 & 0 & 0.162 & -0.002 \\ 0 & 0 & 0.414 & -0.008 \\ 0 & 0 & 0 & 0.248 \end{bmatrix}$
C_1	$\begin{bmatrix} 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
C	$\begin{bmatrix} 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1.0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 \\ 0 & 0 & 1.0 & 0 \\ 0 & 0 & 0 & 1.0 \end{bmatrix}$
3	
D_{21}	$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and wasautomatically imported into ACKREP.
The original description was:
DIS1 Decentralized Interconnected System H. Singh, R. H. Brown and D. S. Naidu, "Unified approach to linear quadrtic regulator with time-scale property", Optimal Control Applications and Methods, Vol.22, pp.1-16, 2001

4 Simulation

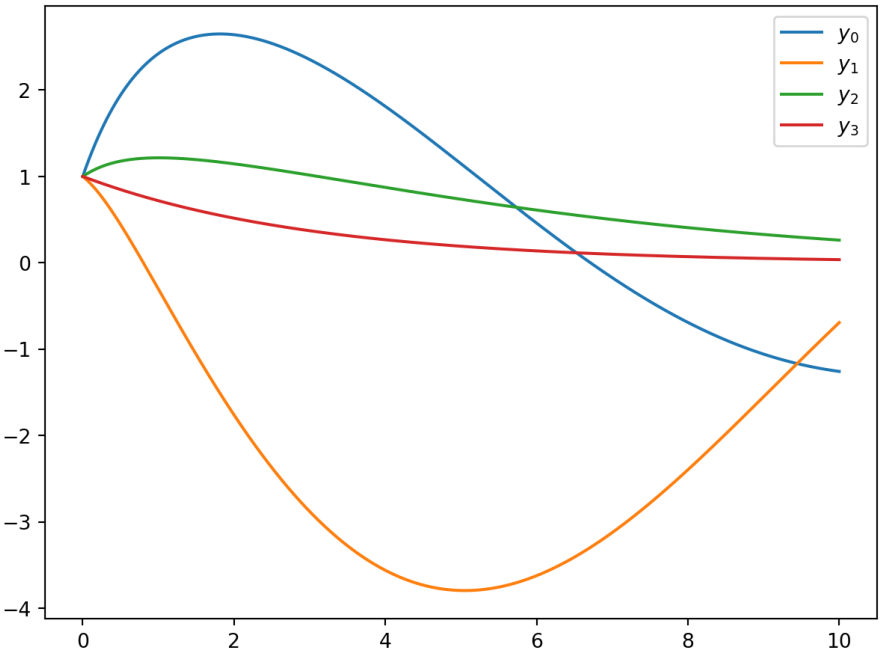

Figure 1: Simulation of the Decentralized Interconnected System.

References

[1] . Singh, R. H. Brown and D. S. Naidu, "Unified approach to linear quadrtic regulator with time-scale property", Optimal Control Applications and Methods, Vol.22, pp.1-16, 2001