Model Documentation of the 'Inverted pendulum'

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:

$$x \in \mathbb{R}^6 u \qquad \in \mathbb{R}^2 w \in \mathbb{R}^2 z \qquad \in \mathbb{R}^2 y \in \mathbb{R}^4$$

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	$\begin{bmatrix} 0 & 1.0 & 0 & 0 & 0 & 0 \\ 48.9844 & 0 & -48.9844 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.18494 & 0 & 0 \\ 0 & 0 & 0 & -50.0 & 0 & 0 \\ 0 & 0 & -0.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
B	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 50.0 \\ 0 & 0 \\ 0 & 0 \\ 1.0 & 0 \end{bmatrix}$
B_1	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 50.0 \\ 0 & 0 \\ 0 & 0 \\ 1.0 & 0 \end{bmatrix}$
C_1	$\begin{bmatrix} 0 & 0 & 0 & 0.0036988 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0 & 0 \end{bmatrix}$
C	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 \\ 1.0 & 0 & -1.0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0 & 0 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
D_{21}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and wasautomatically imported into ACKREP.
The original description was:
ROC10 Inverted pendulum P. Apkarian and H. D. Tuan, "Robust Conrol via Concave Minimization, Local and Global Algorithms", TOAC, Vol. 45, Nr. 2, pp. 299-305, 2000 Ex. 1

4 Simulation

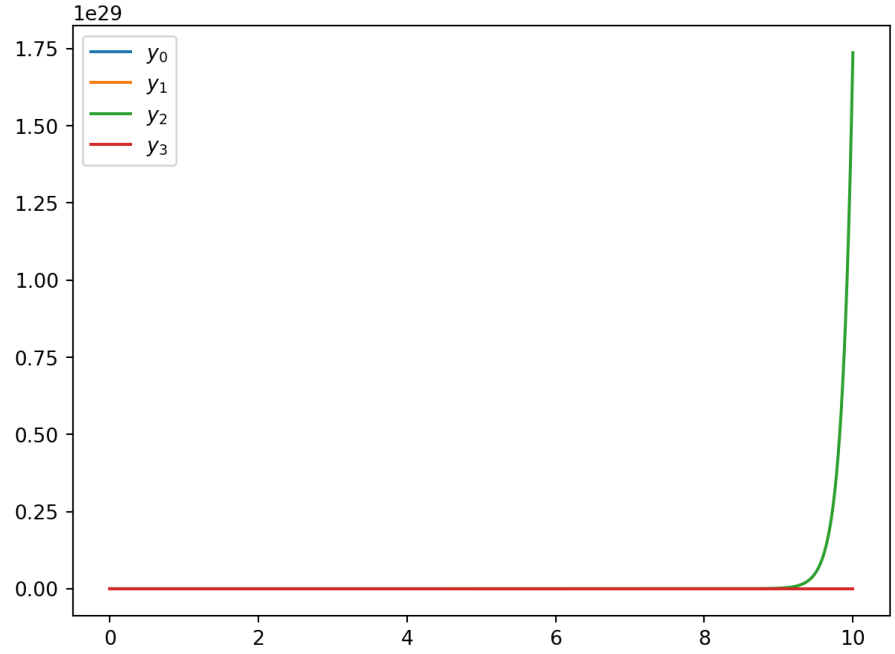

Figure 1: Simulation of the Inverted pendulum.

References

[1] . Apkarian and H. D. Tuan, "Robust Conrol via Concave Minimization, Local and Global Algorithms", TOAC, Vol. 45, Nr. 2, pp. 299-305, 2000 Ex. 1