Model Documentation of the 'Longitudinal motion of a VTOL helicopter'

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:

$$x \in \mathbb{R}^4 u \qquad \in \mathbb{R}^2 w \in \mathbb{R}^2 z \qquad \in \mathbb{R}^2 y \in \mathbb{R}^1$$

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	$\begin{bmatrix} -0.0366 & 0.0271 & 0.0188 & -0.4555 \\ 0.0482 & -1.01 & 0.0024 & -4.0208 \\ 0.1002 & 0.3681 & -0.707 & 1.42 \\ 0 & 0 & 1.0 & 0 \end{bmatrix}$
B	$\begin{bmatrix} 0.4422 & 0.1761 \\ 3.5446 & -7.5922 \\ -5.52 & 4.49 \\ 0 & 0 \end{bmatrix}$
B_1	$\begin{bmatrix} 0.4422 & 0.1761 \\ 3.5446 & -7.5922 \\ -5.52 & 4.49 \\ 0 & 0 \end{bmatrix}$
C_1	$\begin{bmatrix} 1.41421356 & 0 & 0 & 0 \\ 0 & 0.70710678 & 0 & 0 \end{bmatrix}$
C	$\begin{bmatrix} 0 & 1.0 & 0 & 0 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 0.70710678 & 0 \\ 0 & 0.70710678 \end{bmatrix}$
D_{21}	$\begin{bmatrix} 0 & 0 \end{bmatrix}$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and wasautomatically imported into ACKREP.
The original description was:
HE1 Longitudinal motion of a VTOL helicopter S. N. Singh and A. A. R. Coelho, "Nonlinear control of mismatched uncertain linear systems and application to control of aircraft", Journal of Dynamic Systems, Measurement and Control, Vol. 106, pp. 203-210, 1984

4 Simulation

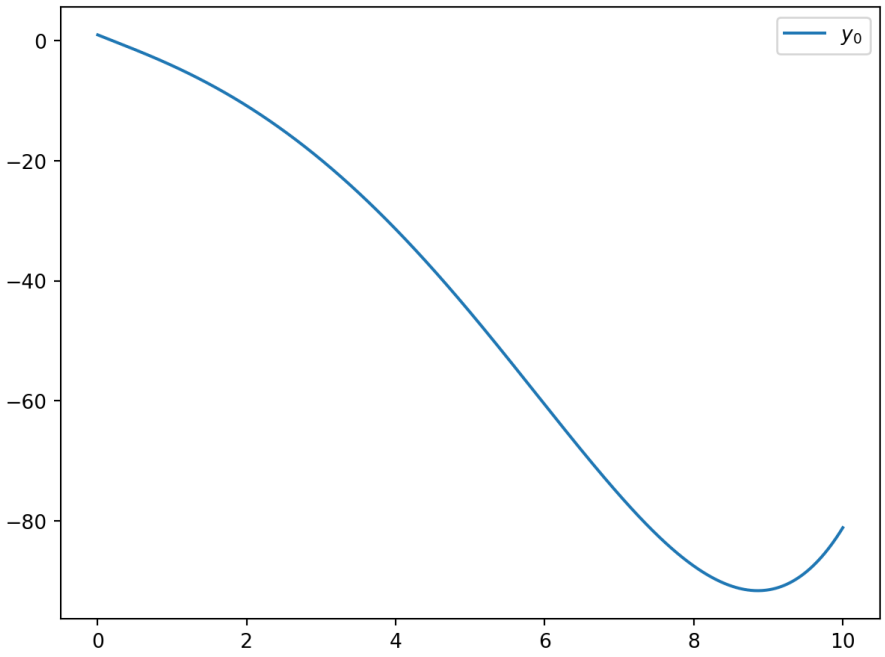

Figure 1: Simulation of the Longitudinal motion of a VTOL helicopter.

References

[1] . N. Singh and A. A. R. Coelho, "Nonlinear control of mismatched uncertain linear systems and application to control of aircraft", Journal of Dynamic Systems, Measurement and Control, Vol. 106, pp. 203-210, 1984