Model Documentation of the 'Helicopter control'

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:

$$x \in \mathbb{R}^2 0 u \qquad \in \mathbb{R}^4 w \in \mathbb{R}^6 z \qquad \in \mathbb{R}^1 6 y \in \mathbb{R}^6$$

System Equations:

$$\dot{x}(t) = Ax(t) + B_1 w(t) + Bu(t) \tag{1a}$$
$$z(t) = C_1 x(t) + D_{11} w(t) + D12 u(t) \tag{1b}$$
$$y(t) = Cx(t) + D21 w(t) \tag{1c}$$

Outputs: z

2.1 Exemplary parameter values

Symbol	Value

A

0	0	0	0.99857378	0.0533842742	0
0	0	1.0	−0.00318221934	0.0595246553	0
0	0	−11.5704956	−2.54463768	−0.0636026263	0.1067805...
0	0	0.439356565	−1.9981823	0	0.01665188...
0	0	−2.04089546	−0.458999157	−0.73502779	0.01925575...
−32.1036072	0	−0.503355026	2.29785919	0	−0.0212158...
0.102161169	32.0578308	−2.34721756	−0.503611565	0.834947586	0.0212265...
−1.9109726	1.71382904	−0.00400543213	−0.0574111938	0	0.01398963...
0	0	0	0	0	−0.00595...
−5.0	0	0	0	0	0
0	−2.0	0	0	0	0
0	0	0	0.10696	−2.0	0
0	0	−2.0	0	0	0
0	0	0	0	0	0
0	0	0	−5.0	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

B

0	0	0	0
0	0	0	0
0.124335051	0.0827858448	−2.75247765	−0.0178887695
−0.0363589227	0.475095272	0.0142907426	0
0.30449152	0.0149580166	−0.496518373	−0.206741929
0.287735462	−0.544506073	−0.0163793564	0
−0.0190734863	0.0163674355	−0.544536114	0.2348423
−4.82063293	−0.000381469727	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
1.0	0	0	0
0	1.0	0	0
0	0	1.0	0
0	0	0	1.0

B_1

0	0	0	0
0	0	0	0
0.124335051	0.0827858448	−2.75247765	−0.0178887695
−0.0363589227	0.475095272	0.0142907426	0
0.30449152	0.0149580166	−0.496518373	−0.206741929
0.287735462	−0.544506073	−0.0163793564	0
−0.0190734863	0.0163674355	−0.544536114	0.2348423
−4.82063293	−0.000381469727	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
1.0	0	0	0

3 Derivation and Explanation

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

The original description was:

HE6 Helicopter control "Multivariable feedback control Analysis and design"
S. Skogestad and I. Postlethwaite John Wiley and Sons, 1996, Section 12.2.3
Note Matlab files http//www.nt.ntnu.no/users/skoge/book/matlab.html stored
in /export/home/leibfr/Lipinski/matlab/.. ..Examples_Multi_Feedback_Control/matlab_m/
F. Leibfritz, 29.10.2003 Data matrices H_inf mixed-sensitivity design generated
by Sec12_2.m in directory above on Laptop cf. page 474, 475 save Heli_Sec12_2_3_Hinf
A B1 B2 C1 C2 D11 D12 D21 D22
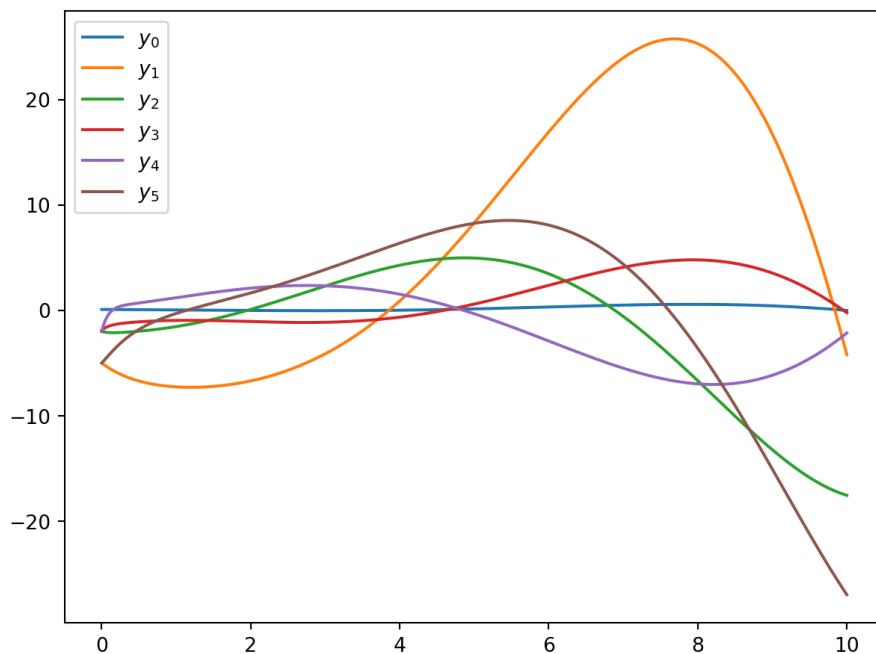
4 Simulation

Figure 1: Simulation of the Helicopter control.

References

[1] Multivariable feedback control Analysis and design" S. Skogestad and I. Postlethwaite John Wiley and Sons, 1996, Section 12.2.3