

# Model Documentation of the 'Four-disk control 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:

$$x \in \mathbb{R}^9 \quad u \in \mathbb{R}^2 \quad w \in \mathbb{R}^2 \quad z \in \mathbb{R}^2 \quad y \in \mathbb{R}^2$$

System Equations:

$$\dot{x}(t) = Ax(t) + B_1w(t) + Bu(t) \tag{1a}$$

$$z(t) = C_1x(t) + D_{11}w(t) + D_{12}u(t) \tag{1b}$$

$$y(t) = Cx(t) + D_{21}w(t) \tag{1c}$$

Outputs:  $z$

## 2.1 Exemplary parameter values

Symbol	Value			
$A$	$\begin{bmatrix} -0.161 & -6.004 & -0.58215 & -9.9835 & -0.40727 & -3.982 & 0 & 0 & 0 \\ 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \end{bmatrix}$			
	$B$	$\begin{bmatrix} 0 & 1.0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1.0 & 0 \\ 0 & 1.0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1.0 & 0 \end{bmatrix}$		
		$B_1$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0.00055 & 0.011 & 0.00132 & 0.018 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$	
			$C_1$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0.00055 & 0.011 & 0.00132 & 0.018 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
				$C$
			$D_{11}$	
			$D_{12}$	$\begin{bmatrix} 0 & 0 \\ 0 & 1.0 \end{bmatrix}$
			$D_{21}$	$\begin{bmatrix} 0 & 0 \\ 0 & 1.0 \end{bmatrix}$

## 3 Derivation and Explanation

This model is part of the "COMpleib" - library and was automatically imported into ACKREP.

The original description was:

ROC1 Four-disk control system K. Zhou, J. C. Doyle, K. Glover, "Robust and optimal control", Prentice Hall, 1996 p. 517, nc=1

## 4 Simulation

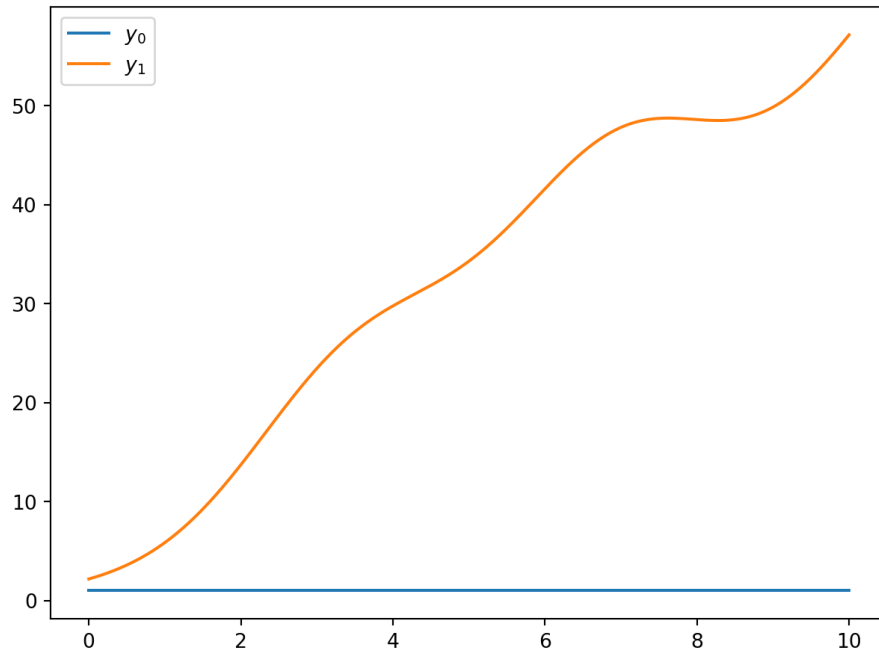


Figure 1: Simulation of the Four-disk control system.

## References

- [1] . Zhou, J. C. Doyle, K. Glover, "Robust and optimal control", Prentice Hall, 1996 p. 517, nc=1