

# Model Documentation of the 'Control surface servo for an underwater vehicle,'

## 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:

$$x \in \mathbb{R}^8 \quad u \in \mathbb{R}^2 \quad w \in \mathbb{R}^2 \quad z \in \mathbb{R}^1 \quad y \in \mathbb{R}^2$$

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			
$A$	$\begin{bmatrix} 0 & 850.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -850.0 & -120.0 & -4100.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 33.0 & 0 & -33.0 & 0 & -700.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1400.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1600.0 & -450.0 & -110.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 81.0 & 0 & -1.0 & 0 & -900.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 110.0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 12.0 & -1.1 & -22.0 \end{bmatrix}$			
	$B$	$\begin{bmatrix} 0 & 0 \\ 4.6 & 99000.0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$		
		$B_1$	$\begin{bmatrix} 0 & 0 \\ 4.6 & 99000.0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$	
			$C_1$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \end{bmatrix}$
			$C$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \end{bmatrix}$
			$D_{11}$	$\begin{bmatrix} 0 & 0 \end{bmatrix}$
			$D_{12}$	$\begin{bmatrix} 1.0 & 0 \end{bmatrix}$
			$D_{21}$	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

## 3 Derivation and Explanation

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

The original description was:

UWV Control surface servo for an underwater vehicle, E. J. Davison, "Benchmark Problems for Control System Design", "Report of the IFAC Theory Committee", 1990 p.32

## 4 Simulation

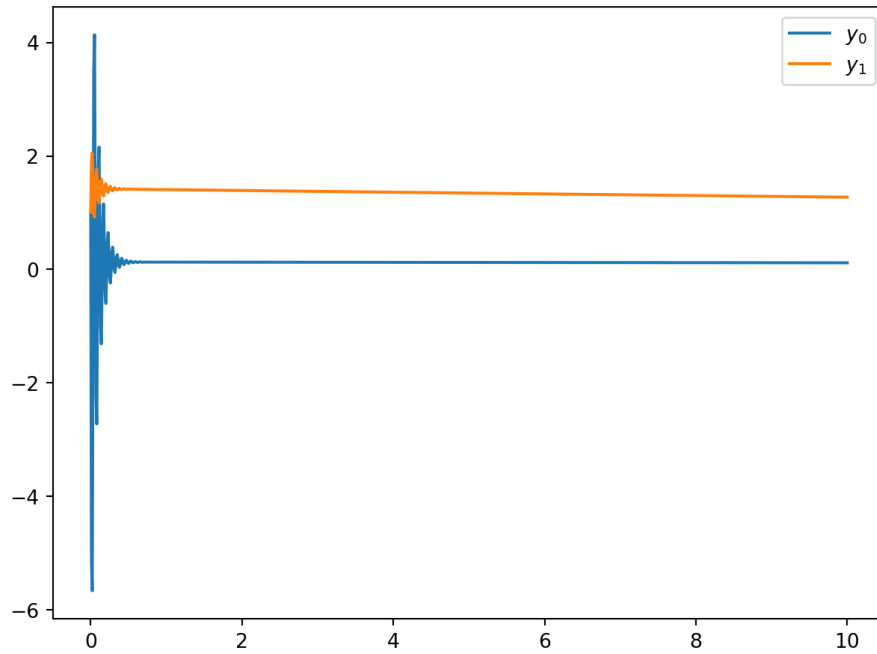


Figure 1: Simulation of the Control surface servo for an underwater vehicle,.

## References

- [1] . J. Davison, "Benchmark Problems for Control System Design", "Report of the IFAC Theory Comittee", 1990 p.32