

Model Documentation of the 'Terrain following model'

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:

$$x \in \mathbb{R}^7 \quad u \in \mathbb{R}^2 \quad w \in \mathbb{R}^1 \quad z \in \mathbb{R}^4 \quad y \in \mathbb{R}^4$$

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	$\begin{bmatrix} -1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & -1.0 & 0 & 0 & 0 \\ -0.088 & 0.0345 & 0 & 0 & 1.0 & -0.0032 & 0 & 0 \\ 0 & 0 & 0.05 & 0 & 0 & 0 & 0 & -1.0 \cdot 10^{-5} \end{bmatrix}$
B	$\begin{bmatrix} 1.0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0.09 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$
B_1	$\begin{bmatrix} 1.0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0.09 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$
C_1	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 0 & 0 & 0 & 2.23 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
C	$\begin{bmatrix} 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 1.73205081 & 0 \\ 0 & 0.54772256 \end{bmatrix}$
D_{21}	$\begin{bmatrix} 0.04 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

3 Derivation and Explanation

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

The original description was:

TF1 Terrain following model E. Gershon, Shaked, Yaesh, Tech.-Rep. 2003 Uni. Tel-Aviv "Static output feedback of state multiplicative systems with application to terrain following" Note This is not a classical SOF control design -> special ROC Q Is the problem SOF stabilizable too ?

4 Simulation

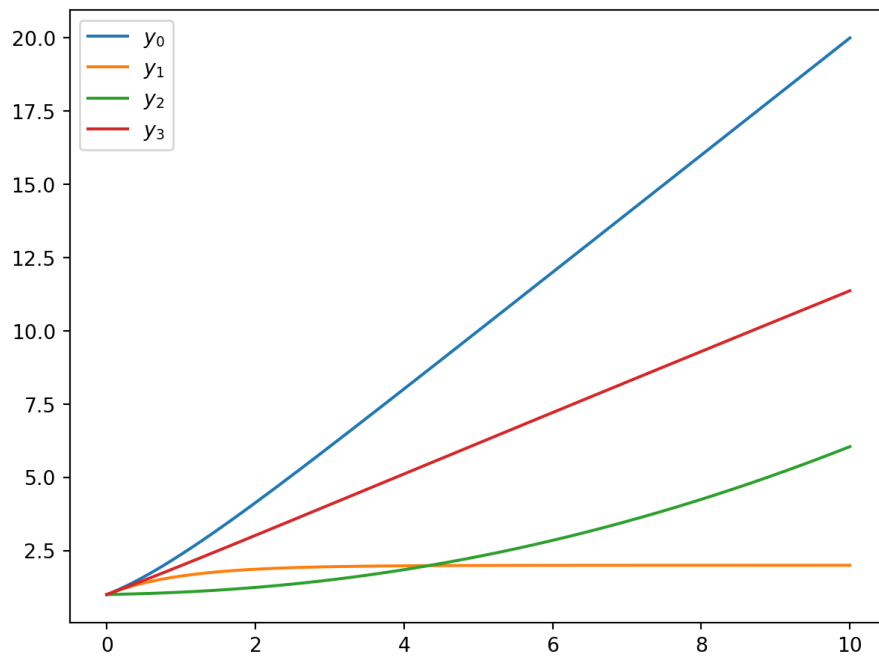


Figure 1: Simulation of the Terrain following model.

References

- [1] . Gershon, Shaked, Yaesh, Tech.-Rep. 2003 Uni. Tel-Aviv "Static output feedback of state multiplicative systems with application to terrain following"