Model Documentation of the 'Output feedback problem Wang and Rosenthal'

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:

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

System Equations:

$$\dot{x}(t) = Ax(t) + B_1 w(t) + Bu(t) \tag{1a}$$

$$z(t) = C_1 x(t) + D_{11} w(t) + D_{12} u(t)$$
(1b)

$$y(t) = Cx(t) + D21w(t) \tag{1c}$$

Outputs: z



2.1 Exemplary parameter values

| Symbol | Value | | | | | | | | | |
|----------|--|--|---|---|----------|--|----------|---|---|--|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1.0 | 0 0 |
| A | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 |
| | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | $\frac{1.0}{0}$ | $0 \\ 1.0$ | $0 \\ 0$ | $0 \\ 0$ | $0 \\ 0$ | $0 \\ 0$ | $0 \\ 0$ | $-1.0 \\ 0$ | $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ |
| | 0 | 0 | 0 | 1.0 | 0 | 0 | 0 | 0 | 0 | $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ |
| | | 0 | 0 | | -1.0 | 0 | 0 | 0 | 0 | $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ |
| | 0 | 0 | 0 | 0 | 0 | 1.0 | 0 | 0 | 0 | $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ |
| | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 |
| B | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | 0 | 0 | -1.0 | | | | | | |
| | 0 | 0 | -1.0 | 0 | | | | | | |
| | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | $0 \\ 0$ | $0 \\ 0$ | $0 \\ 0$ | | | | | | |
| | 0 | 0 | 0 | -1.0 | | | | | | |
| | $\begin{vmatrix} 0 \\ 0 \end{vmatrix}$ | 0 | 0 | 0 | | | | | | |
| | 0 | 0 | 0 | -1.0 | | | | | | |
| | 0 | 0 | 0 | 0 | | | | | | |
| | 0 | 0 | -1.0 | 0 | | | | | | |
| | 1.0 | 0 | 0 | 0 | | | | | | |
| | 0 | 1.0 | 0 | 0 | 1 | | | | | |
| B_1 | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | 0 | 0 | -1.0 | | | | | | |
| | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | $0 \\ 0$ | $-1.0 \\ 0$ | $0 \\ 0$ | | | | | | |
| | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | 0 | 0 | 0 | | | | | | |
| | 0 | 0 | 0 | -1.0 | | | | | | |
| | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | 0 | 0 | 0 | | | | | | |
| | 0 | 0 | 0 | -1.0 | | | | | | |
| | 0 | 0 | 0 | 0 | | | | | | |
| | 0 | 0 | -1.0 | 0 | | | | | | |
| | 1.0 | 0 | 0 | 0 | | | | | | |
| | 0 | 1.0 | 0 | 0 |] | 0 | 0 | 0 | 0 0 | ο 7 |
| | $\begin{bmatrix} 1.0 \\ 0 \end{bmatrix}$ | $0 \\ 1.0$ | $0 \\ 0$ | $0 \\ 0$ | 0 | 0 | 0 | 0 | $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ |
| | 0 | 0 | 1.0 | 0 | 0 | 0 | 0 | 0 | $\begin{array}{ccc} 0 & 0 \\ 0 & 0 \end{array}$ | 0 |
| | 0 | 0 | 0 | 1.0 | 0 | 0 | 0 | 0 | $\begin{array}{ccc} 0 & 0 \\ 0 & 0 \end{array}$ | 0 |
| | 0 | 0 | 0 | | 1.0 | 0 | 0 | 0 | 0 0 | 0 |
| C_1 | 0 | 0 | 0 | 0 | | 1.0 | 0 | 0 | 0 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1.0 | 0 | 0 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | | 1.0 | 0 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1.0 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 1.0 | I . |
| C | $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ | $0 \\ 0 0$ | 0 | $\begin{array}{ccc} 0 & \\ 0 & 0 \end{array}$ | 0 0 | $\begin{array}{cc} 0 \\ 0 \end{array}$ | 0 1.0 | $\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$ | 0 0 | 1.0 |
| | | 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 | | | 0 (| |] | _ | |
| | 1 | 0 0 | 0 0 | |) (B | 0 (| | | | |
| | 1 | 0 0 | 0 0 | | 0 (| 0 (| | | | |
| | 1 | 0 0 | 0 0 | | | 0 (| | | | |
| D_{11} | 1 | 0 0 | 0 0 | | | 0 (| | | | |
| | 1 | $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ | $0 \ 0$ | | | 0 0 | | | | |
| | 1 | $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ | $\begin{array}{ccc} 0 & 0 \\ 0 & 0 \end{array}$ | | | 0 0 | | | | |
| | 1 | $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ | $\begin{array}{ccc} 0 & 0 \\ 0 & 0 \end{array}$ | | | 0 0 | | | | |
| | | | 0 0 | 0 (| , 0 | 0 (| , 0 | | | |

3 Derivation and Explanation

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

The original description was:

ROC3 Output feedback problem Wang and Rosenthal ehemals ROC8 "Output feedback pole placemant with dynamic compensatores" TOAC, vol.41, Nr. 6, pp. 830-843, 1996 Example 3.21, nc=2

4 Simulation

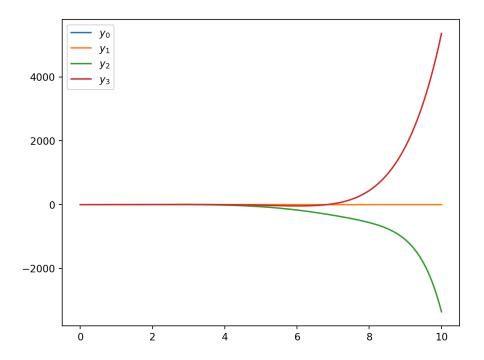


Figure 1: Simulation of the Output feedback problem Wang and Rosenthal.

References

[1] Output feedback pole placemant with dynamic compensatores" TOAC, vol.41, Nr. 6, pp. 830-843, 1996 Example 3.21, nc=2