

Simulation Parameters

Ruixuan Zhao, Guitao Yang, Peng Li, and Boli Chen

This is a supplementary document for the journal paper “Relaxed Unknown Input Observer Design: from Centralized to Distributed” submitted to CDC 2025.

PARAMETERS IN SECTION V. SIMULATION RESULTS

A. Centralized UIO

$$L = \begin{bmatrix} -5 & 5 \\ 5 & -5 \\ 20 & -18 \end{bmatrix}, \quad P_{W_g^*}^\top = \begin{bmatrix} -0.7071 & 0 \\ 0.7071 & 0 \\ 0.0000 & 1 \end{bmatrix} = E,$$

$$\bar{A}_L = \begin{bmatrix} -8.0000 & 0.7071 \\ -28.2843 & 1.0000 \end{bmatrix}, \quad F^\top = \begin{bmatrix} 0.5 & 0.5 & 0 \\ 0.5 & 0.5 & 0 \end{bmatrix}.$$

B. Distributed UIO

$$L_1^\top = \begin{bmatrix} -5 & 0 & 0 & -0 & 0 & 0 \\ 0 & -1 & 0 & 3 & 3 & 0 \end{bmatrix},$$

$$L_2^\top = \begin{bmatrix} -0 & -2 & 0 & 0 & 0 & -4 \end{bmatrix},$$

$$L_3^\top = \begin{bmatrix} 0 & 0 & -5 & 2 & 0 & -0 \\ -3 & 0.75 & 0 & 0 & 3 & -0.75 \end{bmatrix},$$

$$L_4^\top = \begin{bmatrix} -3 & -0 & -0 & -0 & -0 & 0 \end{bmatrix}.$$

$$\bar{A}_{L_1} = \begin{bmatrix} 0.0000 & 1.4142 & 0.0000 & 0.0000 & 1.4142 \\ -2.8713 & -2.5000 & 1.0000 & -2.0000 & -2.5000 \\ 0.0000 & 0.0000 & -2.0000 & 0.0000 & 0.0000 \\ 0.0000 & 3.0000 & 1.0000 & 0.0000 & -3.0000 \\ -1.3713 & -2.5000 & -1.0000 & 2.0000 & -2.5000 \end{bmatrix},$$

$$\bar{A}_{L_3} = \begin{bmatrix} 0.7071 & 0.5000 & 0.0000 & -2.0000 & 0.7071 \\ 0.0000 & -5.0000 & 2.0000 & 0.0000 & 0.0000 \\ 0.0000 & -1.0000 & -2.0000 & 0.0000 & 0.0000 \\ 3.0000 & 0.0000 & 1.0000 & 0.0000 & -3.0000 \\ -0.7071 & -0.5000 & 0.0000 & 2.0000 & -0.7071 \end{bmatrix}.$$

$$P_{W_1^*} = \begin{bmatrix} 0.0000 & 1.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 \\ -0.7071 & 0.0000 & 0.5000 & 0.0000 & 0.0000 & -0.5000 \\ 0.0000 & 0.0000 & 0.0000 & 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & 1.0000 & 0.0000 \\ -0.7071 & 0.0000 & -0.5000 & 0.0000 & 0.0000 & 0.5000 \end{bmatrix},$$

$$P_{W_3^*} = \begin{bmatrix} -0.7071 & 0.5000 & 0.0000 & 0.0000 & 0.0000 & -0.5000 \\ 0.0000 & 0.0000 & 1.0000 & 0.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & 1.0000 & 0.0000 \\ -0.7071 & -0.5000 & 0.0000 & 0.0000 & 0.0000 & 0.5000 \end{bmatrix}.$$

$$V_1^\top = \begin{bmatrix} -0.0000 & 0.0000 & -0.3439 & 0.3439 & 0.2111 & -0.8195 \\ 0.0000 & 0.0000 & -0.0935 & 0.0935 & 0.4040 & 0.1825 \\ -0.0000 & 0.0000 & 0.4066 & -0.4066 & 0.3068 & -0.2623 \end{bmatrix},$$

$$V_3^\top = \begin{bmatrix} -0.1273 & -0.3394 & -0.0000 & 0.0000 & 0.1211 & -0.9241 \\ 0.0180 & 0.0480 & 0.0000 & -0.0000 & -0.9874 & -0.1495 \\ -0.3267 & -0.8713 & -0.0000 & 0.0000 & -0.1016 & 0.3517 \end{bmatrix}.$$

$$E_1 = \begin{bmatrix} 0.0000 & -0.3536 & 0.0000 & 0.0000 & -0.3536 \\ 1.0000 & -0.0000 & 0.0000 & 0.0000 & -0.0000 \\ -0.0000 & -0.0000 & 0.0000 & 0.0000 & 0.0000 \\ -0.0000 & -0.0000 & 1.0000 & 0.0000 & 0.0000 \\ 0.0000 & 0.0000 & -0.0000 & 1.0000 & 0.0000 \\ 0.0000 & -1.0000 & 0.0000 & 0.0000 & 1.0000 \end{bmatrix},$$

$$F_1^\top = \begin{bmatrix} 0.5000 & -0.0000 & -0.0000 & -0.0000 & 0.0000 & -0.0000 \\ 0.0000 & 0.0000 & 1.0000 & 0.0000 & 0.0000 & 1.0000 \end{bmatrix},$$

$$E_3 = \begin{bmatrix} -0.7071 & 0.0000 & 0.0000 & 0.0000 & -0.7071 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & -0.0000 \\ -0.0000 & 0.5000 & 0.0000 & 0.0000 & 0.0000 \\ 0.0000 & -0.0000 & 1.0000 & -0.0000 & -0.0000 \\ -0.0000 & 0.0000 & 0.0000 & 1.0000 & 0.0000 \\ -1.0000 & -0.0000 & 0.0000 & 0.0000 & 1.0000 \end{bmatrix},$$

$$F_3^\top = \begin{bmatrix} 0.0000 & 0.0000 & 0.5000 & -0.0000 & -0.0000 & 0.0000 \\ 0.0000 & 1.0000 & 0.0000 & -0.0000 & 0.0000 & 1.0000 \end{bmatrix}.$$

$$W_{g,2}^* = \begin{bmatrix} -0.2661 & 0.5686 & -0.2944 & 0.0021 & -0.1848 \\ -0.1328 & 0.0058 & 0.2693 & -0.0385 & 0.4700 \\ 0.1618 & 0.4080 & 0.0537 & -0.0842 & -0.1680 \\ -0.1518 & -0.6434 & -0.3644 & -0.0497 & -0.0318 \\ 0.3903 & 0.0340 & -0.3269 & 0.0048 & 0.1889 \\ 0.0812 & -0.3065 & 0.2591 & -0.0040 & -0.4699 \end{bmatrix},$$

$$W_{g,4}^* = \begin{bmatrix} 0.0000 & -0.0000 & -0.0000 & 0.0000 & 0.0000 \\ 0.1005 & 0.1266 & -0.1338 & 0.2756 & -0.9381 \\ 0.2743 & 0.2154 & 0.0758 & -0.9081 & -0.2192 \\ -0.5484 & -0.6613 & 0.3726 & -0.2267 & -0.2678 \\ 0.2234 & 0.2628 & 0.9151 & 0.2086 & -0.0099 \\ 0.7510 & -0.6567 & -0.0099 & 0.0671 & 0.0130 \end{bmatrix}.$$

$$\chi = 224.7422, \quad \gamma = 21.7682.$$