Exercise 13: Observability

Note: This is an exercise for the exam preparation.

Problem 29:

We again consider the active vehicle suspension system from Problem 28. We recall the state equations

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -\frac{c}{m} & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ \frac{K \cdot A}{m} \end{bmatrix} u(t)$$
$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} x(t)$$

We assume that all parameters c, K, A, m are positive constants.

a. Show that the system is observable.

In order to realize the state feedback with the vector $k^T = \begin{bmatrix} \frac{m}{K \cdot A}(25 - \frac{c}{m}) & \frac{10 \cdot m}{K \cdot A} \end{bmatrix}$ designed in Problem 28, we need to observe both states of tbe system (see also Problem 28 **e.**).

b. Design a state observer such that the eigenvalues of the observation error equation lie at $s_1 = -10$ and $s_2 = -10$.

c. Sketch the overall block diagram with the state observer in **b.** and the state feedback in Problem 28 **e.**