

## State-Space Realizations of Transfer Functions

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \underbrace{\begin{pmatrix} 0 & 1 \\ -6 & -5 \end{pmatrix}}_A \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \underbrace{\begin{pmatrix} 0 \\ 1 \end{pmatrix}}_B u, \quad y = \underbrace{\begin{pmatrix} 1 & 1 \end{pmatrix}}_C \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$
$$G(s) = \frac{s + 1}{s^2 + 5s + 6}$$

— at least in this example, information about the state-space model  $(A, B, C)$  is contained in  $G(s)$ .

Is this information *recoverable*? — i.e., is there only one state-space realization of a given t.f.? Or are there many?

**Answer:** There are infinitely many!