

Beware of Pole-Zero Cancellations!!

Here is a **really bad** realization of the t.f.

$$G(s) = \frac{1}{s + 3}.$$

Use a two-dimensional model:

$$\dot{x}_1 = -3x_1 + u$$

$$\dot{x}_2 = 100x_2$$

$$y = x_1$$

- ▶ x_2 is not affected by the input u (i.e., it is an uncontrollable mode), and not visible from the output y
- ▶ does not change the transfer function
- ▶ ... and yet, horrible to implement: $x_2(t) \propto e^{100t}$

The transfer function can mask undesirable internal state behavior!!