EE 105 Feedback control systems

Playing with sytems in MATLAB

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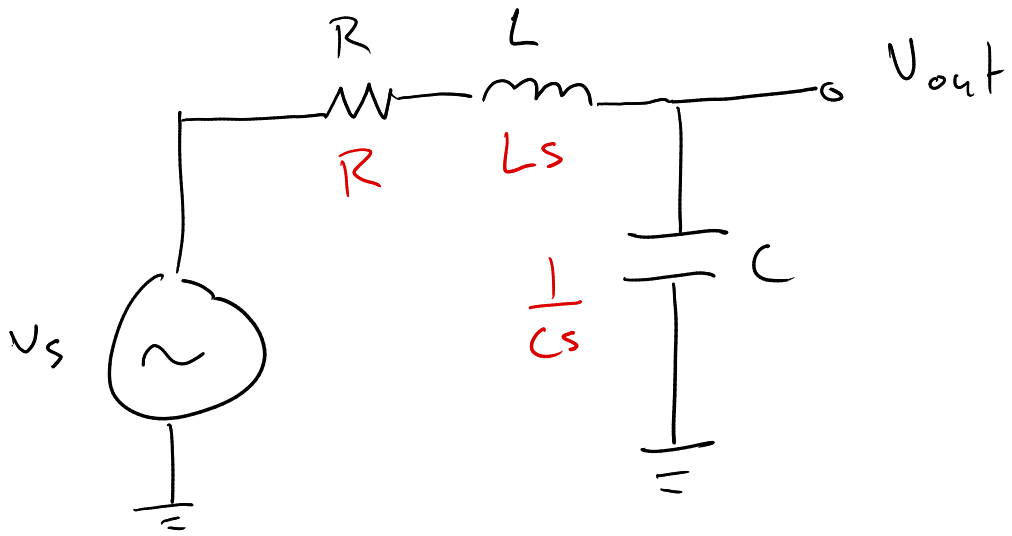
By the end of class today, you should be able to:

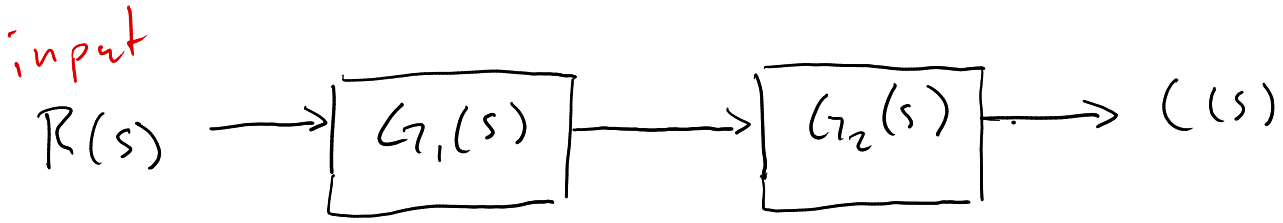
- Use the MATLAB symbolic toolbox to do stuff with transfer functions
- Use MATLAB functions to explore the time-domain behavior of systems
- Use MATLAB to convert between state space and transfer function representations

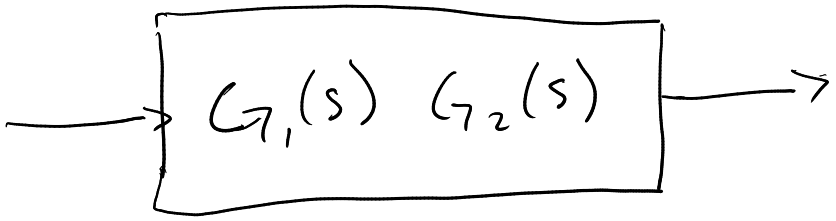
Back to our circuit example



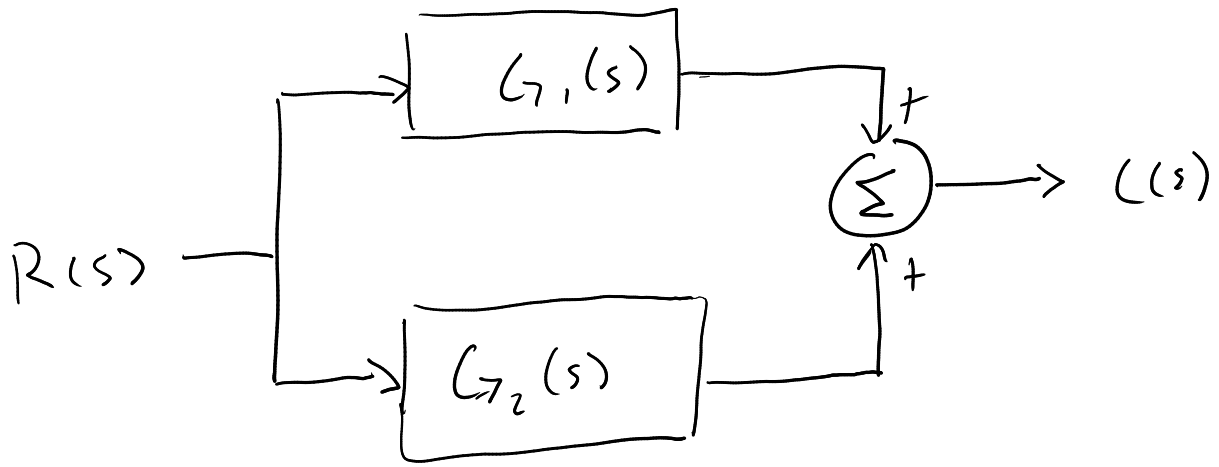
$$\frac{Y(s)}{U(s)} = H(s) = \frac{1}{LCs^2 + RCs + 1}$$

Composing transfer functions





Composing transfer functions

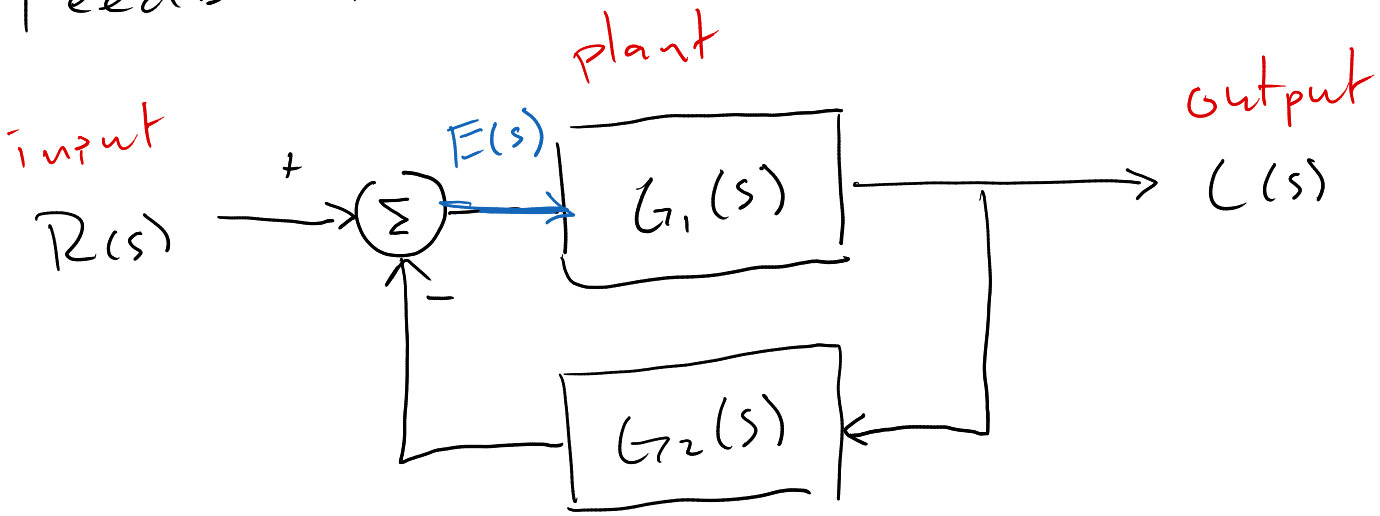


$$C(s) = R(s)G_1(s) + R(s)G_2(s)$$ factor out $R(s)$

$$R(s) \rightarrow \boxed{G_1(s) + G_2(s)} \rightarrow C(s)$$

Composing transfer functions

Feedback



$$E(s) = R(s) - C(s)\,G_2(s)$$

$$C(s) = E(s)\,G_1(s)$$

$$C(s) = \left(R(s) - C(s)\,G_2(s)\right) G_1(s)$$

$$C(s) = G_1(s)\,R(s) - G_1(s)\,G_2(s)\,C(s)$$

$$C(s)\left(1 + G_1(s)\,G_2(s)\right) = G_1(s)\,R(s)$$

$$H(s) = \frac{C(s)}{R(s)} = \frac{G_1(s)}{1 + G_1(s)\,G_2(s)}$$

Formalizing "system"