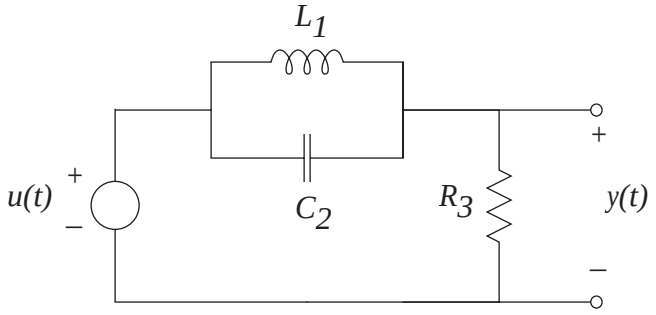
Problem S13 (Signals and Systems)

Consider the RLC circuit below:



This circuit is a *notch filter*, meaning that the output $y(t)$ is almost the same as the input $u(t)$, except that the circuit "filters out" frequencies in a narrow range, determined by the component values. For example, this circuit might be used to filter out 60 Hz noise caused by electrical wiring from the input to an audio system, to prevent 60 Hz "hum."

For this circuit, find a state-space description of the system, in the form

$$\begin{aligned} \frac{d\underline{x}(t)}{dt} &= A\underline{x}(t) + Bu(t) \\ y(t) &= C\underline{x}(t) + Du(t) \end{aligned}$$

No component values are given, so just find the matrices A, B, C, and D in symbolic form.