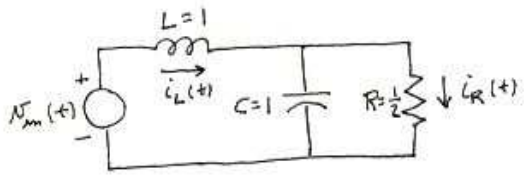
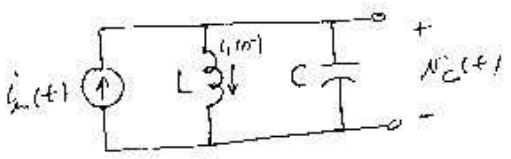
520.214 Signals and Systems, H13-08
Due Friday, May 2, 2008

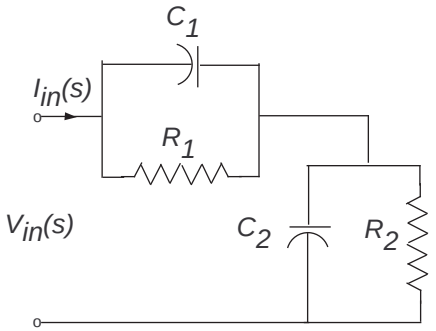
1. Consider the circuit shown below, where the input voltage is $v_{in}(t) = u(t)$ and the initial conditions are $i_L(0^-) = 1$, $v_c(0^-) = 0$. Compute the current through the resistor, $i_R(t)$ for $t \geq 0$.



2. For the circuit shown below, with $L = 1$ and $C = 1$, suppose the input current is $i_{in}(t) = 2u(t)$, the initial current in the inductor is $i_L(0^-) = 1$ in the direction shown, and the initial voltage on the capacitor is zero. Compute the voltage output, $v_C(t)$.



3. Determine the input impedance $Z_{in}(s)$ of this circuit:



5 For the system with transfer function

$$\frac{Y(s)}{X(s)} = \frac{s-3}{(s+4)^2}$$

compute the steady-state response $y_{ss}(t)$, the time function that $y(t)$ approaches asymptotically, as $t \to \infty$, to the input signals

(a) $x(t) = e^{-3t}u(t)$
(b) $x(t) = e^{3t}u(t)$
(c) $x(t) = 2\sin(3t)u(t)$ (Skip calculation of the phase angle. Simply call it θ.
(d) $x(t) = \delta(t)$

(e) $x(t) = u(t)$

(Yes, I know that I promised this would include only circuits problems, but this last one is important, so I included it.)