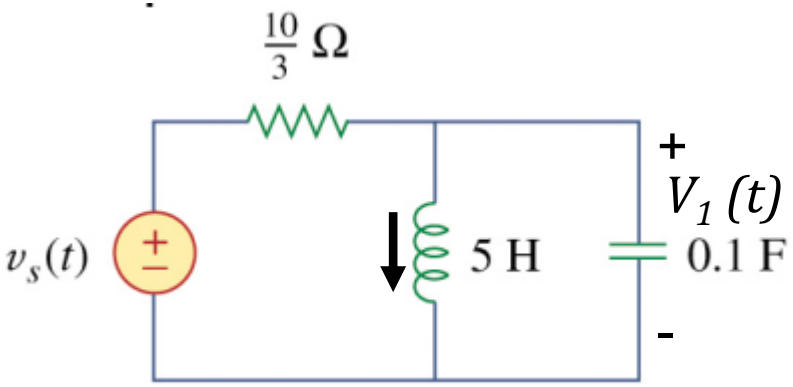
Lecture 14
-- Laplace Transform in Circuit Analysis

Example 2

Find (1) the voltage across the capacitor

(2) current through the inductor

assuming that $v_s(t) = 10u(t)$ V, and assume that at $t = 0$, *-1 A* flows through the inductor and +5 V is across the capacitor.



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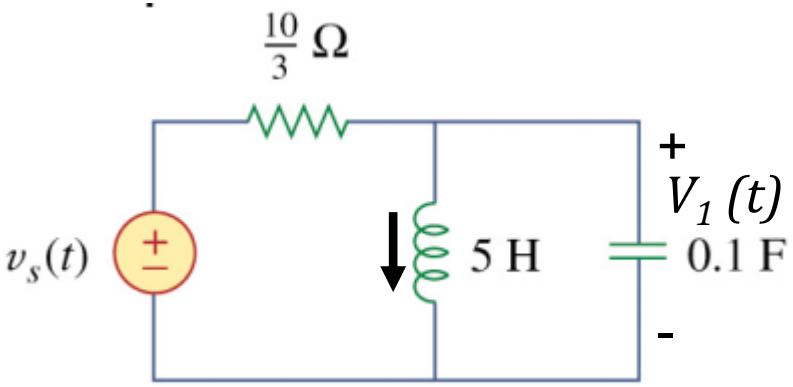
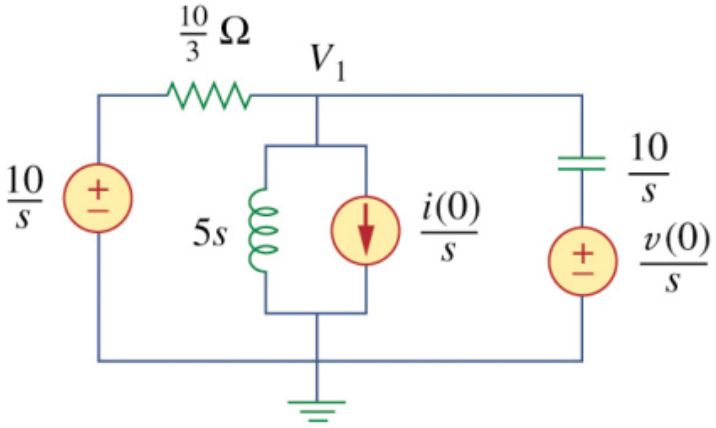
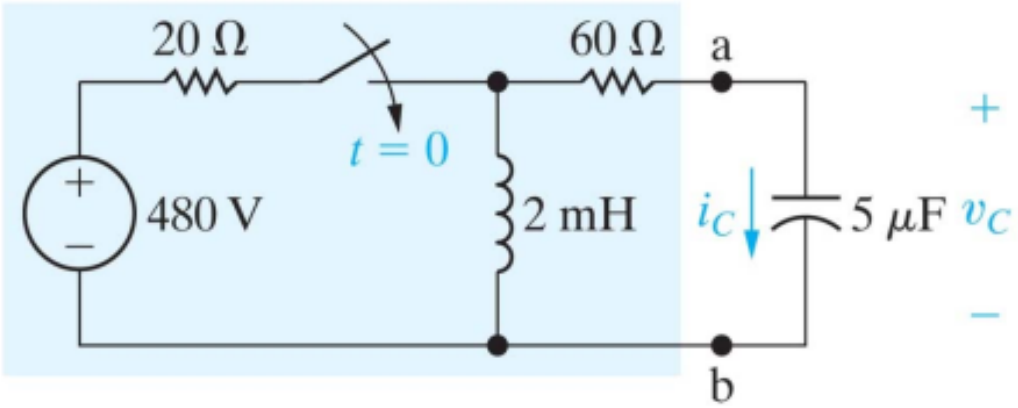




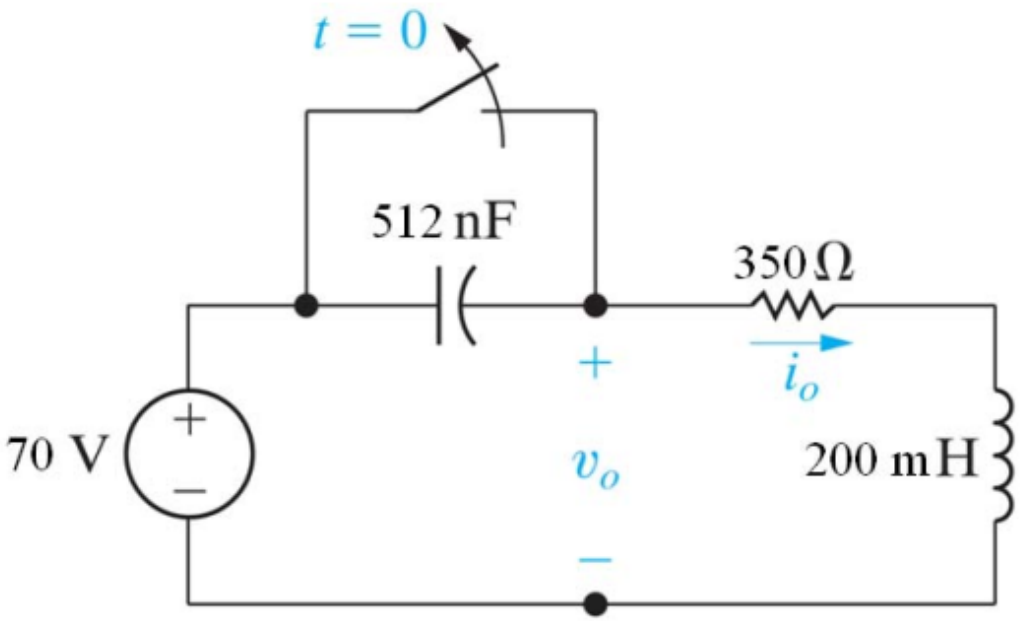
Example 3

- Use Thevenin's equivalent circuit w.r.t. terminals *a*-*b* to find current $i_C(t)$ for $t>0$.



Example 4

- Find V_o *(t) for t>0*



$$V_0(s) = \frac{70s - 268{,}125}{s^2 + 1750s + 9{,}765{,}625} = \frac{K_1}{(s + 875 - j3000)} + \frac{K_2}{(s + 875 + j3000)}$$

$$K_1 = \left.\frac{70s - 268{,}125}{(s + 875 + j3000)}\right|_{s=-875+j3000} = \frac{70(-875 + j3000) - 268{,}125}{[(-875 + j3000) + 875 + j3000]} = 65.1\angle 57.48^\circ$$

$$K_2 = \left.\frac{70s - 268{,}125}{(s + 875 - j3000)}\right|_{s=-875-j3000} = \frac{70(-875 - j3000) - 268{,}125}{[(-875 - j3000) + 875 + -j3000]} = 65.1\angle -57.48^\circ$$

$$V_0(s) = \frac{65.1\angle 57.48^\circ}{(s + 875 - j3000)} + \frac{65.1\angle -57.48^\circ}{(s + 875 + j3000)}$$

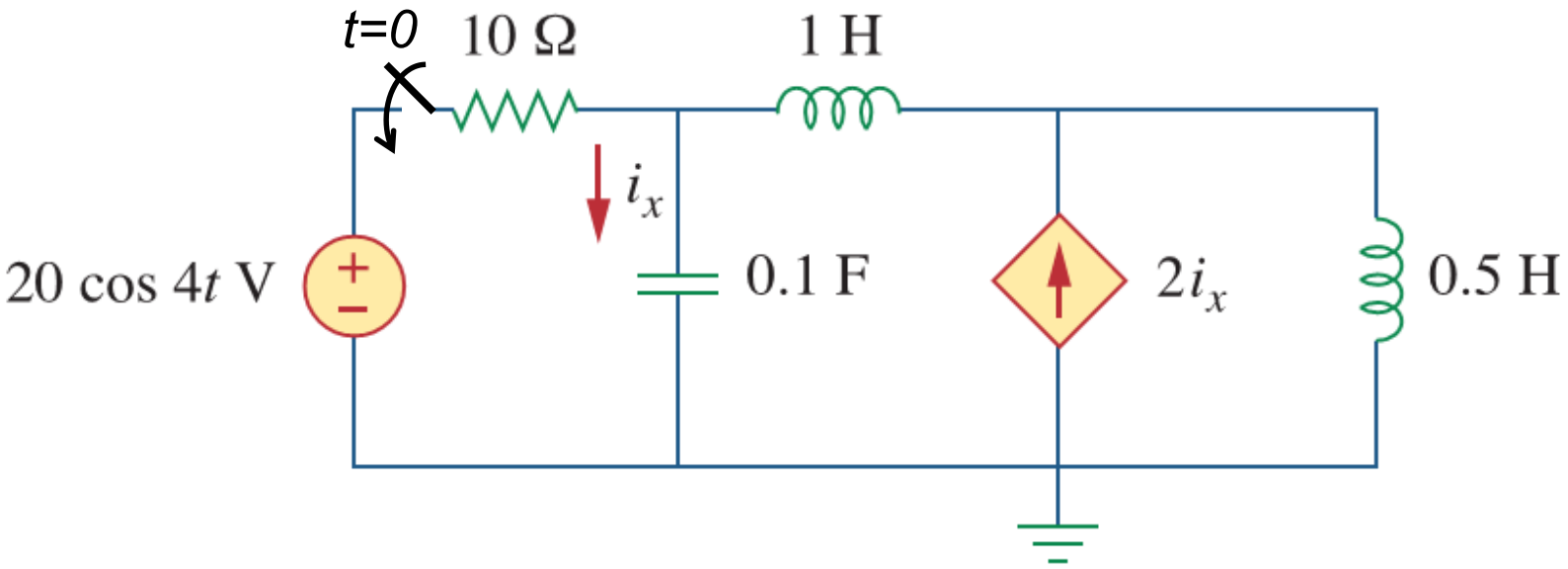
$$v_0(t) = 2(65.1)e^{-875t}\cos(3000t + 57.48^\circ) = 130.2e^{-875t}\cos(3000t + 57.48^\circ)u(t)\ \text{V}$$

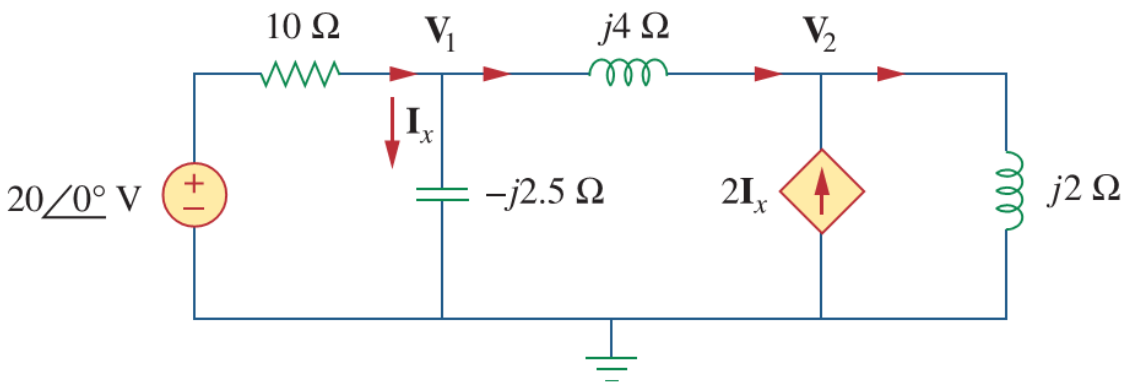
Example 5

- Example---Find i_x(s.s.) assuming no initial energy stored

Using (1)phasor method

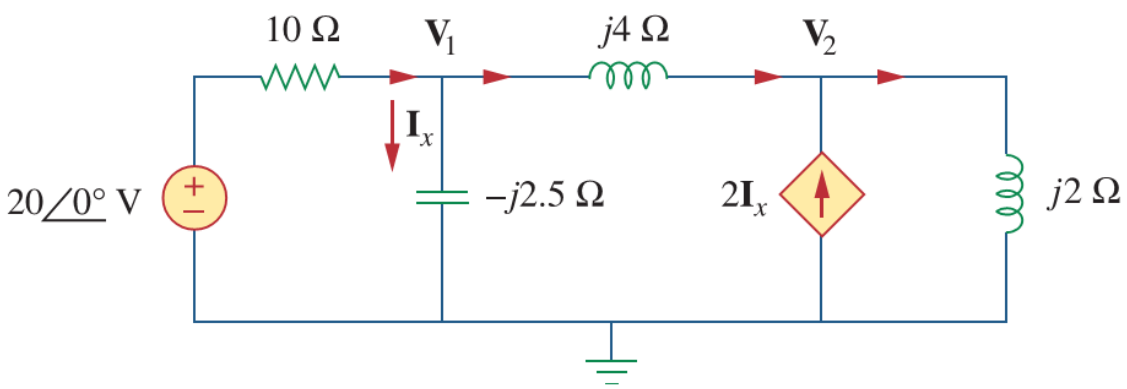
(2)Laplace transform method





$$\frac{20 - \mathbf{V}_1}{10} = \frac{\mathbf{V}_1}{-j2.5} + \frac{\mathbf{V}_1 - \mathbf{V}_2}{j4}$$

$$2\mathbf{I}_x + \frac{\mathbf{V}_1 - \mathbf{V}_2}{j4} = \frac{\mathbf{V}_2}{j2}$$



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$$i_x = 7.59\cos(4t + 108.4°)\ \text{A}$$

Example 6

- There is no initial energy stored in this circuit. Find $i(t)$ if
- $v(t) = e^{-0.6t} \sin 0.8t$ V.