Homework 8

Due data: Jun.15th

Turn in your homework before 8:15 AM

Rules:

- Please work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism!
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

1

[8 points]Calculate the Laplace transform of the following functions. You can use definitions or properties of Laplace transform. Hint:$cosh(t) = \frac{e^t+e^{-t}}{2}$

(a). f(t)=$((1-t)e^{-t} - te^{-t}sint)u(t)$

(b). g(t)=$8e^{-3t}cosh(t)u(t-2)$

2

[12 points]Calculate the inverse Laplace transform of the following functions.

(a). F(s)=$\frac{s^2-2s+1}{4(s-2)(s^2+2s+4)}$

(b). G(s)=$\frac{4(s-1)}{s^4-1}+\frac{7}{s(s+1)^3}+1$

(c). P(s)=$\frac{se^{-\pi s}}{s^2+5}$

3

[18 points]The function $f(t)$ is shown in **Fig.3**. $f(t) = 0$ for $t \leq 0$.
(a). Calculate the Laplace transform of $f(t)$.
(b). Verify the initial value thereom for $f(t)$.
(c). Verify the final value theorem for $f(t)$.

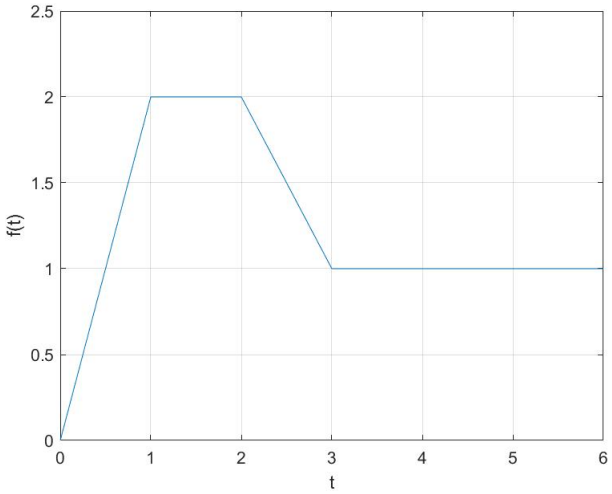

Figure 3:

4

[18 points]The circuit is shown in **Fig.4**. Assume the circuit has reached steady state before t = 0s. Given that C = $\frac{1}{9}$F, R = 3Ω, L = 0.6H, i(t) = $te^{-t}u(t) + 5u(-t)$ A, determine U1(t) for t > 0s using Laplace domain method.

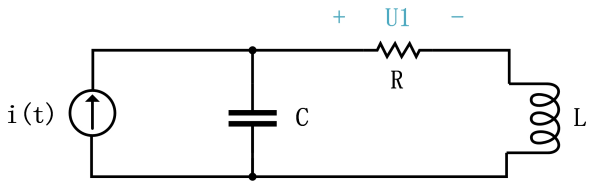

Figure 4:

5

[18 points]The circuit is shown in **Fig.5**. The ideal operator amplifier is working at its linear region and $v_1(0-) = 3V, v_2(0-) = 2V$. And a voltage source is applied to the circuit with $v_s(t) = e^{-t}u(t)V$. Determine the $v_o(t)$ for t>0 s with Laplace transform.

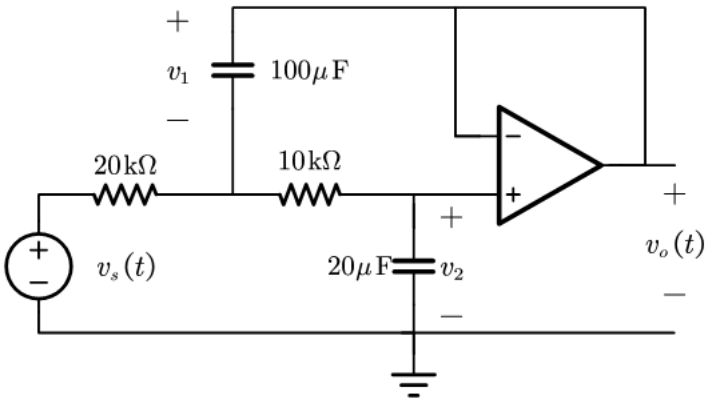

Figure 5:

6

[26 points]The circuit is shown in **Fig.6**. Given that $U_C(0_-)$=1V, $i_C(0_-)$=2A.

(a). Use the time domain method to determine $i_L(t)$ for t > 0s.

(b). Use the Laplace transform to determine $i_L(t)$ for t > 0s.

(c). Use the phasor domain method to determine $i_L(t)$ if the circuit has reached the sinusoidal steady state.

(d). Determine the value of $i_L(t)$ at $t = 1s$ and $t = 100s$ using the three expressions you obtained above respectively. Explain why the values are the same or different.

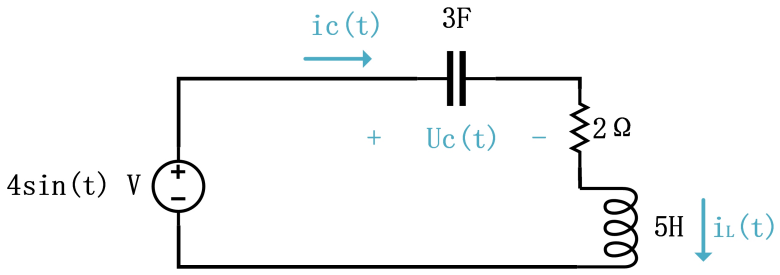

Figure 6: