CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science

ENGR 210. Introduction to Circuits and Instruments (4)

Homework Set No. 10 Issued 3/23/05
References: [T&R4] sections 6-1 to 6-4. Due 3/30/05

Waveform partial descriptors

1) Measurements of a periodic sinusoidal waveform.

A periodic waveform can be expressed as V(t)=100-200cosπt-75sin40000πt+35cos80000πt millivolts

(a) What is the period of the waveform?

(b) What is the average value of the waveform?

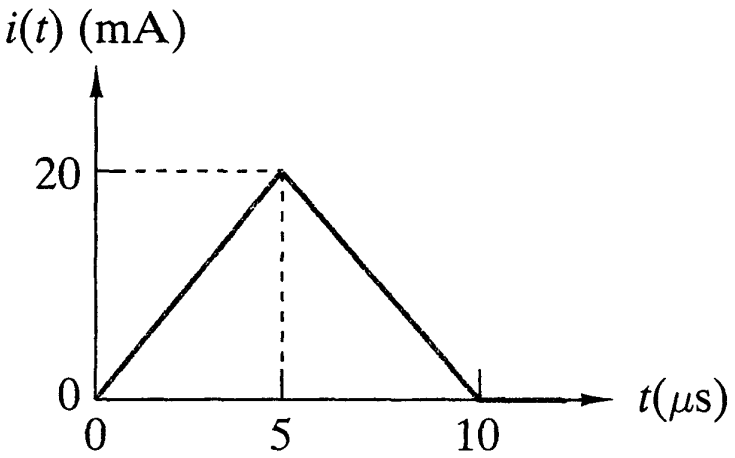
(c) What is the amplitude of the fundamental component?

(d) What is the highest frequency in the waveform?

Capacitor and inductor responses

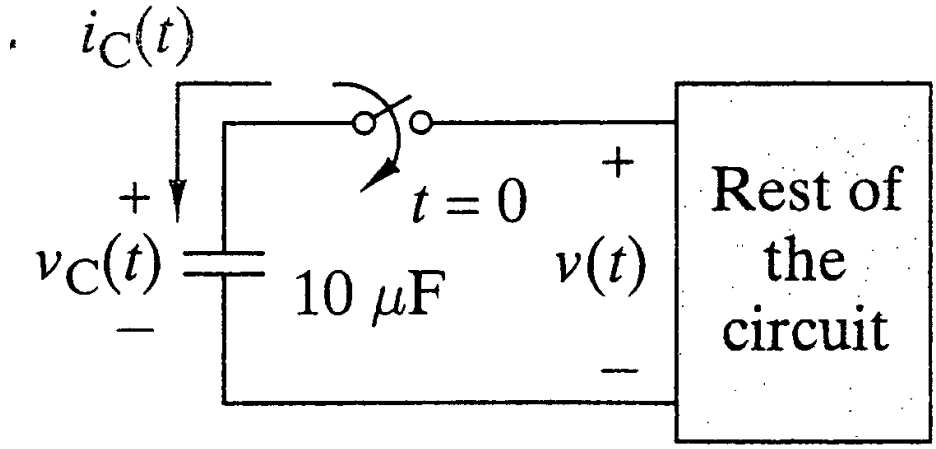
2) (5 pts) Problem 6-12, p. 272. Inductive power and energy.

The current through a 25-mH inductor is shown in the figure below. Prepare sketches of $v_L(t)$, $p_L(t)$, and $w_L(t)$. Is the inductor absorbing power, delivering power, or both?



3) (5 pts) Problem 6-14, p. 273.Capacitive power and energy.

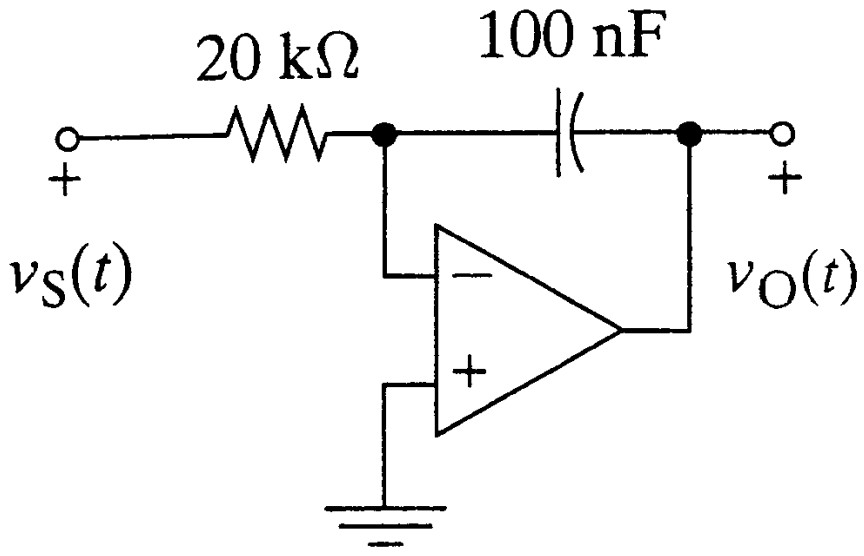
The capacitor in the figure below carries an initial voltage $v_C(0)$=25 volts. At t=0, the switch is closed, and thereafter the voltage across the capacitor is $v_C(t)=50-25e^{-5000t}$ volts. Derive expressions for $i_c(t)$ and $p_c(t)$. Is the capacitor absorbing power, delivering power, or both?



Dynamic OP AMP circuits

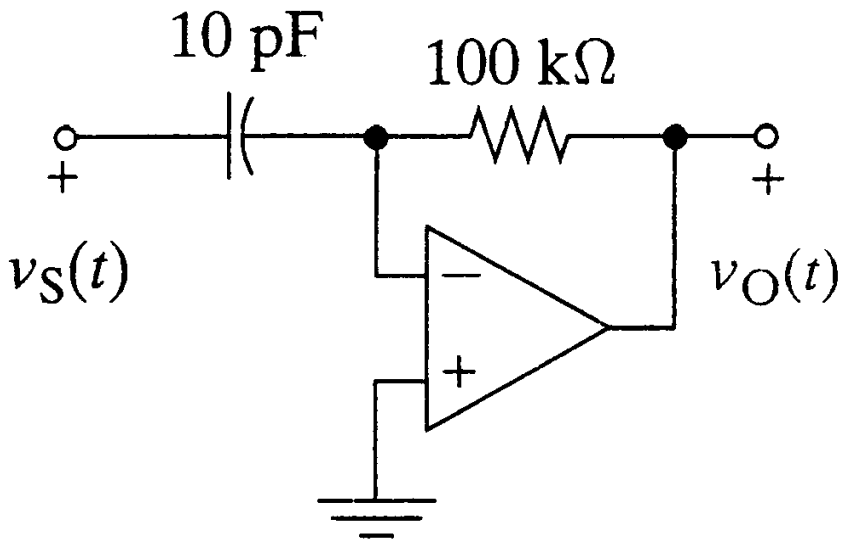
4) (5 pts) Problem 6-26, p. 273-274. Integrator.

At t=0 the voltage across the capacitor in the figure below is zero. The OP AMP saturates at ±15 volts. For $v_s(t) = 5[\sin \omega t]u(t)$ volts, derive an expression for the output voltage for the OP AMP in its linear range. What is the minimum value of ω for linear operation?



5) (5 pts) Problem 6-29, p. 273-274. Integrator.

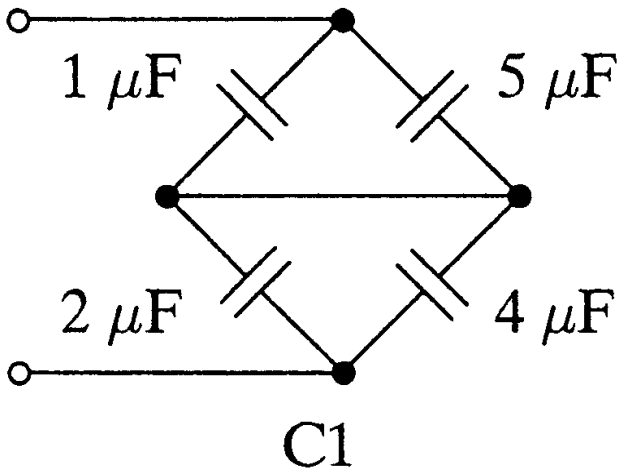
The input to the circuit shown below is $v_S(t)=5[e^{-\alpha t}]u(t)$ volts. Derive an expression for the output voltage for the OP AMP in its linear range. If the OP AMP saturates at ±15 volts, what is the maximum value of α for linear operation?

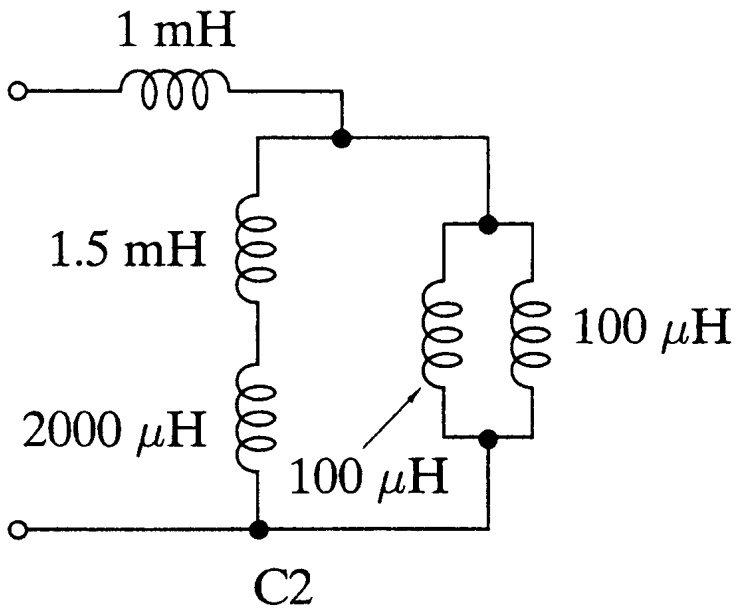


Equivalent inductance and capacitance

6) (5 pts) Problem 6-36, p. 274. Equivalent reactance.

Find a single equivalent capacitance for circuit C1 and a single equivalent inductance for circuit C2.





NOTE: Please put your section code AND your CWRU e-mail next to your name at the top of the page. Section codes are

MA (Monday Afternoon)
ME (Monday Evening)
TA (Tuesday Afternoon)
TE (Tuesday Evening)
WA (Wednesday Afternoon)
WE (Wednesday Evening)

Homework is due at the beginning of class on the assigned day.