EENG382 QUIZ #1 (Rev 01)

Problem #1

A periodic voltage waveform can be described as follows: The voltage transistions between a “low” voltage, V_L, and a “high” voltage, V_H, via a linear ramp. The voltage is low 20% of the time and high 50% of the time with the remaining 30% split evenly between the two transitional ramps. If V_L=10V and V_H=20V, what are the average and rms voltages of this waveform?

Problem #2

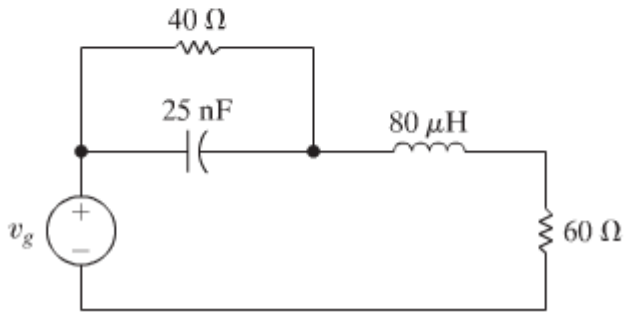
10.18 PSPICE MULTISIM

a) Find the average power, the reactive power, and the apparent power supplied by the voltage source in the circuit in Fig. P10.18 if $v_g = 40 \cos 10^6 t$ V.

b) Check your answer in (a) by showing $P_{dev} = \sum P_{abs}$.

c) Check your answer in (a) by showing $Q_{dev} = \sum Q_{abs}$.

Figure P10.18



Problem #3

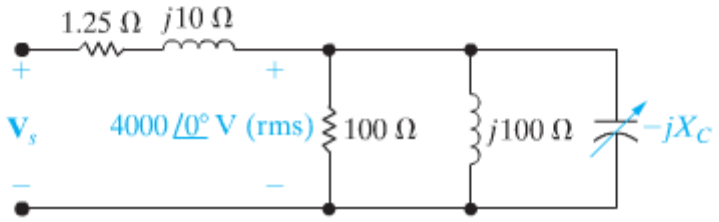
10.54 The sending-end voltage in the circuit seen in Fig. P10.54 is adjusted so that the rms value of the load voltage is always 4000 V. The variable capacitor is adjusted until the average power dissipated in the line resistance is minimum.

a) If the frequency of the sinusoidal source is 60 Hz, what is the value of the capacitance in microfarads?

b) If the capacitor is removed from the circuit, what percentage increase in the magnitude of $\mathbf{V}_s$ is necessary to maintain 4000 V at the load?

c) If the capacitor is removed from the circuit, what is the percentage increase in line loss?

Figure P10.54



Problem #4

Find the one-sided Laplace transform of the following function beginning with the definition of the one-sided Laplace transform.

$e^{-at}\cos \omega t$ (damped cosine)

Problem #5

Prove/derive the following operation Laplace transform

$$f(at),\ a > 0 \qquad \frac{1}{a} F\left(\frac{s}{a}\right)$$

TABLE OF LAPLACE TRANSFORMS

An Abbreviated List of Laplace Transform Pairs

$f(t)$ $(t > 0^-)$	Type	$F(s)$
$\delta(t)$	(impulse)	1
$u(t)$	(step)	$\frac{1}{s}$
t	(ramp)	$\frac{1}{s^2}$
e^{-at}	(exponential)	$\frac{1}{s + a}$
$\sin \omega t$	(sine)	$\frac{\omega}{s^2 + \omega^2}$
$\cos \omega t$	(cosine)	$\frac{s}{s^2 + \omega^2}$
te^{-at}	(damped ramp)	$\frac{1}{(s + a)^2}$
$e^{-at} \sin \omega t$	(damped sine)	$\frac{\omega}{(s + a)^2 + \omega^2}$
$e^{-at} \cos \omega t$	(damped cosine)	$\frac{s + a}{(s + a)^2 + \omega^2}$

An Abbreviated List of Operational Transforms

$f(t)$	$F(s)$
$Kf(t)$	$KF(s)$
$f_1(t) + f_2(t) - f_3(t) + \cdots$	$F_1(s) + F_2(s) - F_3(s) + \cdots$
$\frac{df(t)}{dt}$	$sF(s) - f(0^-)$
$\frac{d^2 f(t)}{dt^2}$	$s^2F(s) - sf(0^-) - \frac{df(0^-)}{dt}$
$\frac{d^n f(t)}{dt^n}$	$s^n F(s) - s^{n-1} f(0^-) - s^{n-2} \frac{df(0^-)}{dt} - s^{n-3} \frac{df^2(0^-)}{dt^2} - \cdots - \frac{d^{n-1} f(0^-)}{dt^{n-1}}$
$\int_0^t f(x)\, dx$	$\frac{F(s)}{s}$
$f(t - a)u(t - a), a > 0$	$e^{-as} F(s)$
$e^{-at} f(t)$	$F(s + a)$
$f(at), a > 0$	$\frac{1}{a} F\left(\frac{s}{a}\right)$
$tf(t)$	$-\frac{dF(s)}{ds}$
$t^n f(t)$	$(-1)^n \frac{d^n F(s)}{ds^n}$
$\frac{f(t)}{t}$	$\int_s^\infty F(u)\, du$