# ECE 209L - AVERAGE POWER OF PERIODIC SIGNALS - LAB 18
## AVERAGE POWER OF SQUAREWAVES

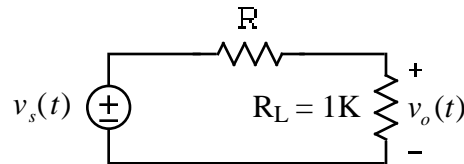**FALL 2003**                                                                 **A.P. FELZER**

## OBJECTIVE

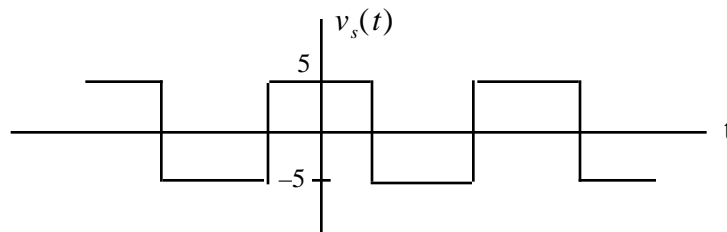The objective of this experiment is to measure and make use of rms values of squarewaves

## LAB

1. Given the following circuit



PARTNER 1: R = 1K       PARTNER 2: R = 2K
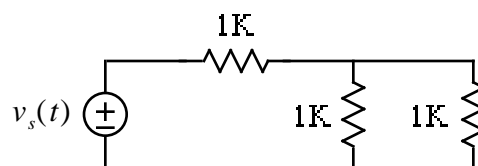
where $v_s(t)$ is a squarewave of freqency 1KHz as follows



a. **Prelab** - Obtain and measure your resistor values. Then compare your nominal and measured values. Put your results in a Table
b. Sketch $v_o(t)$ as displayed on the scope
c. Make use of your result in part (b) to obtain a graph of $v_o^2(t)$
d. Make use of your result in part (c) to obtain an expression for $V_{rms}$ as follows

$$V_{rms} = \sqrt{\frac{1}{T} \int_T v_o^2(t)dt}$$

e. Use a "regular" voltmeter to measure $V_{rms}$ of $v_o(t)$
f. Use a true rms voltmeter to measure $V_{rms}$ of $v_o(t)$
g. Compare your values for $V_{rms}$ in parts (d), (e) and (f). Explain what's going on
h. Make use of the real value of $V_{rms}$ to calculate the average power $P_{av}$ of $R_L$
i. Experimentally determine how varying the frequency of the squarewave affects the $V_{rms}$ values in this **resistor** circuit

2. Given the following circuit with squarewave input as above



*1*

a. **Prelab** - Obtain and measure your resistor values. Then compare your nominal and measured values. Put your results in a Table
b. Find $V_{rms}$ and $I_{rms}$ for each circuit element
c. Make use of your results in part (b) to calculate the average power $P_{av}$ of each circuit element - including the source
d. Make use of your results in part (c) to verify that the average power being supplied by the source is equal to the sum of the powers being dissipated by the resistors