konstantin.rykov@tut.fi

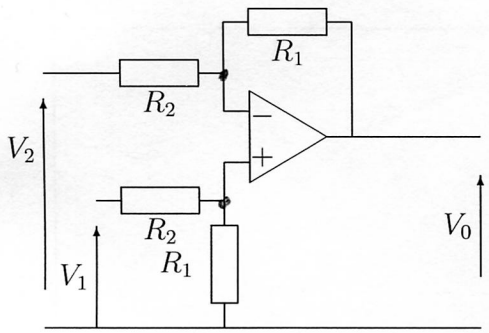
SMG-8046 RF-electronics preparatory I

Small Exam 2, 10.10.11 at 9.15

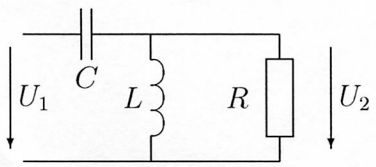
Answer to three of the four questions. Each question gives maximum of 5 points.

1. (a) Explain how the transfer function is defined. Explain also what kind of information can be obtained from the transfer function.

   (b) Consider the following circuit. Assume ideal operational amplifier and analyze V_0 as function of V_1 and V_2. Based on your result, how would you characterize the connection.

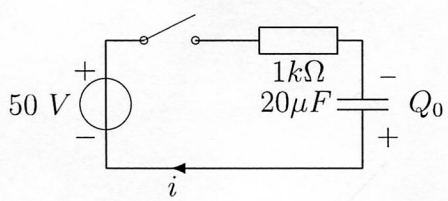


2. (a) Find the transfer function $\frac{U_2}{U_1}$ for the following case. Let $C = 1\text{F}$, $L = 1\text{H}$, $R = 1\Omega$. Find value for the transfer function when $\omega = 0$ and $\omega = \infty$. How would you reason the results.



   (b) Find the Taylor polynomial of degree 4 for $f(x) = \sin(x)$.

3. (a) The switch in the circuit below is closed at $t = 0$, the capacitor has at that moment charge $Q_0 = 500\mu\text{C}$ (whose polarity is as in the picture). Obtain i and charge q in the capacitor for $t > 0$, also sketch the graph of q.



   (b) Describe how the directional derivative is defined, reason also why and where such a construction could be needed.

TURN OVER

4. (a) In the Gram–Schmidt process we encounter terms like $\frac{<f_k,g>}{<f_k,f_k>} f_k$ where f_k, g are scalar functions and

$$< f, g >= \int_a^b f g dx$$

defines an inner product for functions in the interval $[a, b]$. Explain how to interpret this kind of terms.

(b) Consider the plot below, it is obtained using Matlab and the Fourier tools. Describe it briefly. Suppose that you would need to get rid of the first two peaks. Form a (as simple as possible) circuit, include also possible values for components of the circuit.