Signal and Data Analysis

Exercise 4

25.4.2008

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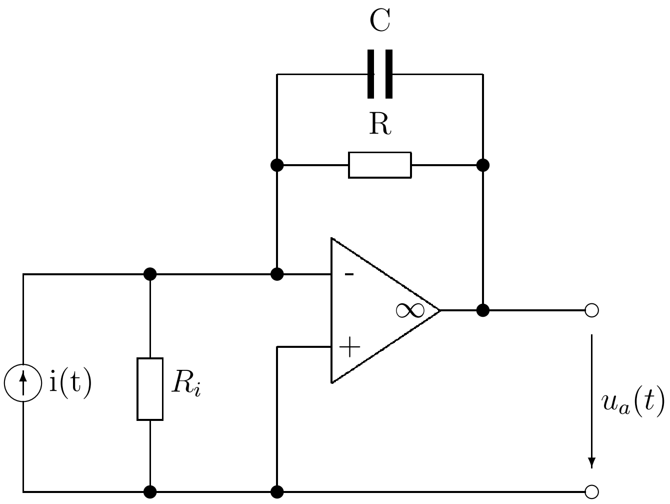
1 Charge-sensitive Preamplifier

Determine with the help of the Laplace transformation $u_a(t)$ for the integrator (see below). Calculate $u_a(t)$ using the Laplace transformation for the two different input currents $i(t)$:



Determine $u_a(t)$ for

a) i(t) $= Q_0\delta(t)$

b) i(t) $= \frac{Q_0}{T}[\Theta(t) - \Theta(t-T)]$ assuming T << RC.

c) Check the results using the theorems for $t = 0$ (initial value theorem) and $t \to \infty$ (final value theorem).

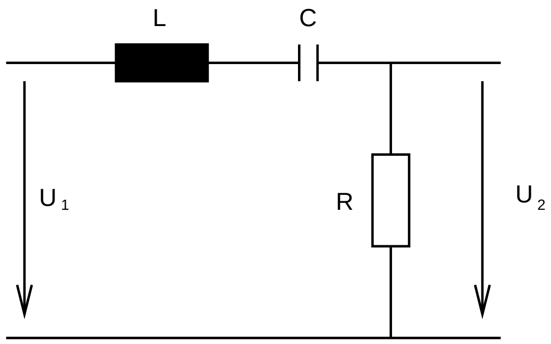
Reminder: For an ideal operational amplifier the following statements hold:

Rule 1: If an ideal operational amplifier is used with negative feedback in its linear regime, both inputs (inverted "-" and non-inverted "+") are on same potential

Rule 2: Both inputs have infinitely high input resistance $R_i \to \infty$

2 Band Filter

Determine the transfer function $G(s)$ of the following passive filter.



Plot the Bode diagrams ($20\text{dB} \log_{10}|G(j\omega)|$, $\phi(\omega)$) as function of $\log_{10}(\omega/\omega_0)$ schematically. Which kind of filter is it?