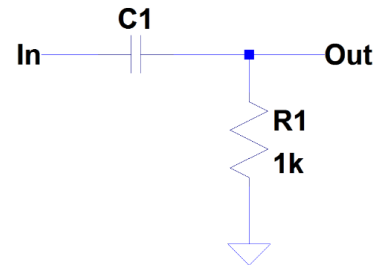


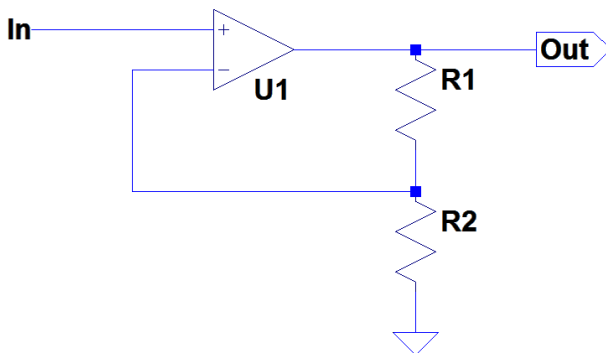
**Measurement Methods in Physics I**  
**Fall 2016**  
**Exercise 6**  
**18.10 - 20.10**

**Hand-in assignments. You have to return an answer sheet, even if it would be empty.**  
 Return by 13.10.2016 16:00.

1. The adjacent figure shows a simple high-pass filter. Calculate the capacitance of C1, so that the -6 dB corner frequency is 100 kHz.



2. Below is a figure of a normal non-inverting amplifier circuit. Derive the amplification of the circuit and calculate its error using propagation of error when  $R1 = 1\text{ k}\Omega \pm 1\%$  and  $R2 = 10\text{ k}\Omega \pm 2\%$ . Is the 1 or 2 % tolerance of the resistor realistic?



3. Traceability (4 points!!!)

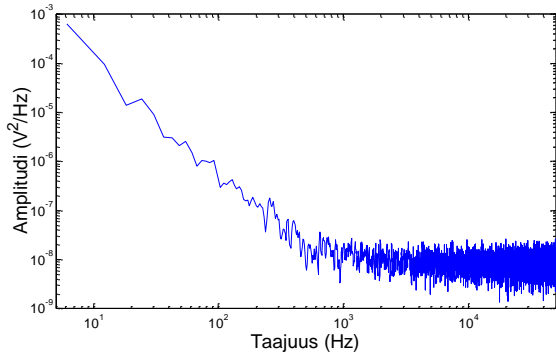
- What is the definition of traceability?
- What is the standard guide for traceable measurements and what does it define?
- Determine the error sources in the case of scanning white light interferometer (SWLI) measurement related to A: light source, B: camera, C: optomechanical setup, at least 2 sources each (information on the instrument “*Three-dimensional sensing of rough surfaces by coherence radar*”, T. Dresel et. al, Applied Optics, Vol. 31, Issue 7, pp. 919-925, 1992.)
- In addition to error sources present in static SWLI measurements what error sources in stroboscopic SWLI measurements of oscillating samples (information on SSWLI: “*Stroboscopic white-light interference microscopy*”, P. de Groot, Applied Optics, Vol. 45, Issue 23, pp. 5840-5844, 2006.)

**"Check box"-assignments. Bring these to the exercise session.**

- What is the Seebeck effect and what kind of errors can it cause in measurements?
- In what practical applications is the Seebeck effect utilised?

5. The susceptibility to noise of two sensors are examined by measuring a constant input. Thus, all variation in the sensors' output voltage is caused by noise. The output time series were centred by subtracting from them their respective averages, and the power spectra of the resultant time series were calculated. Which types of noise are visible in the spectra? (Amplitudi=Amplitude, Taajuus=frequency)

a)



b)

