# Signal Processing – Analog Part

Assignment 2018

Remarks:

- In order to submit the assignment, the soft copy report and design tool files have to be submitted via email to Prof. Ulf Witkowski (email: witkowski.ulf@fh-swf.de) within the due date.

- Email subject has to be stated with your surname as 'Surname_Analog_MSc18'.

- This assignment score is 20% of Signal Processing module.

- If a student gets less than 40% of the assignment score, the student will fail.

- This assignment is prohibited to do in team. If plagiarisms have been found, both the original and the copied versions will be noticed as fail, automatically.
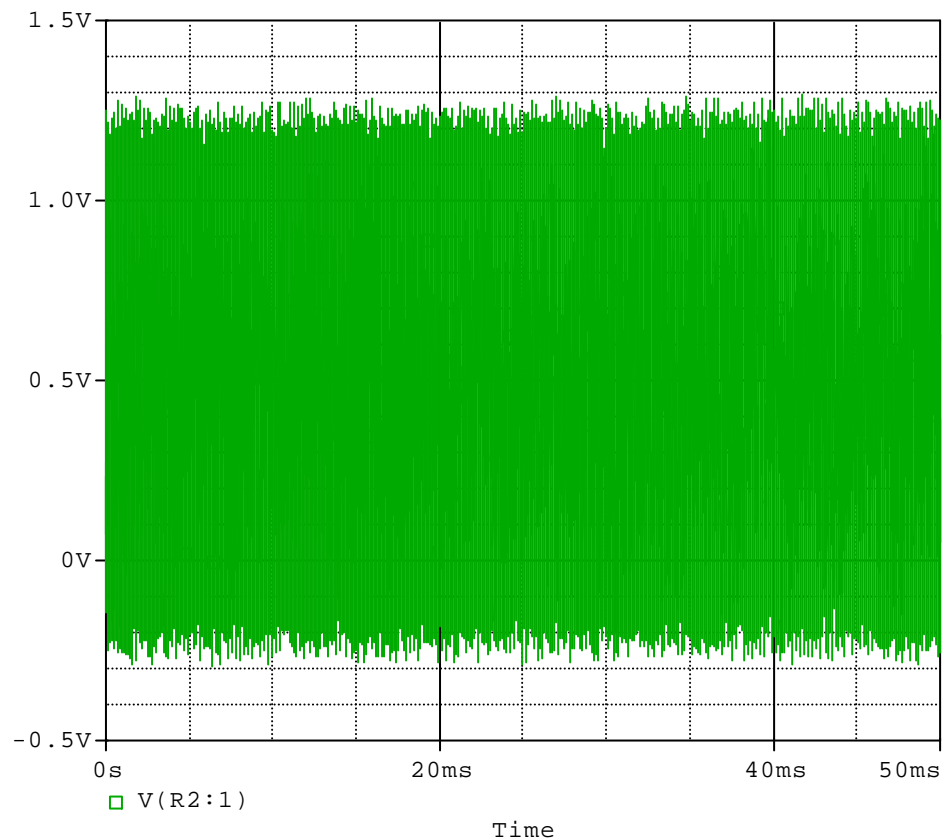
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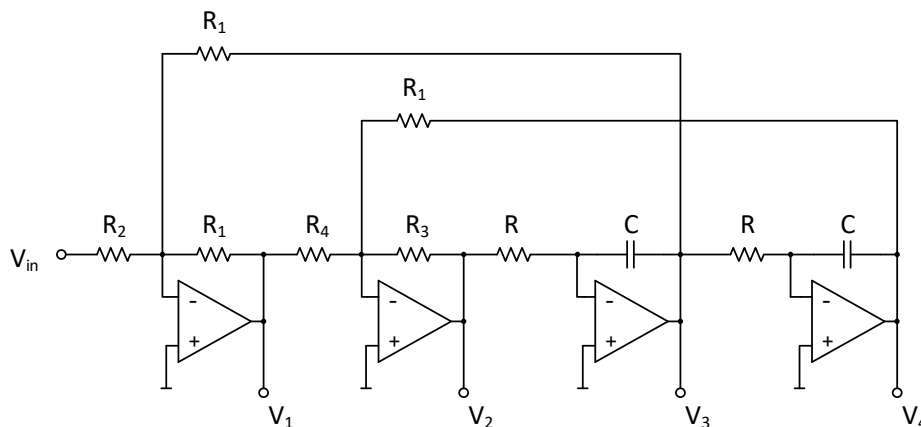
Task 1.1: Calculate the transfer functions of all four outputs (V2 – V4):

$$H_1(s)=\frac{V_1(s)}{V_{in}(s)} \qquad H_2(s)=\frac{V_2(s)}{V_{in}(s)} \qquad H_3(s)=\frac{V_3(s)}{V_{in}(s)} \qquad H_4(s)=\frac{V_4(s)}{V_{in}(s)}$$

Task 1.2: Determine the specific filter characteristic of each output. What are the general transfer functions for each filter type? [H_{LP}, H_{HP}, H_{BP}, H_{BS}]

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□ V(R2:1)

Time

You are asked to process a noisy signal. The only information given is the frequency of the wanted signal, it is f_{target} = 42 kHz. Your task is to design a suitable filter circuit to extract this signal, a SNR of 30 dB is required. There are several options to realize the requested filter circuit using active filter. For this assignment a PSpice project is available in the download area on the Omega server. The provided project contains a voltage source generating the noisy signal.

Task 2.1: Design a filter circuit to isolate and amplify the target waveform. Please document your solution. Select a filter topology and document your filter circuit. Calculate the transfer functions of your filter. Determine the required resistor and capacitor values. For realizing the filter, resistor and capacitor values have to be taken from the E-24 sequence. What are the resistors and capacitors that are close to the calculated ones? Explain your choice, why do you choose this specific filter topology for your design.

Task 2.2: Implement your circuit in PSpice/OrCAD Capture. Therefore, select suitable operational amplifiers, also justify your selection. Use PSpice/OrCAD Capture to analyse the performance of your design in both time and frequency domain.