PROTOCOL

to laboratory exercise

RC-Sine-Wave-Oscillator

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RC-Sine-Wave-Oscillator

Used Devices

Nr.	Device	Manufactor	Type	Place Nr.
1.	Function Generator	HAMEG	HM8030-6	-
2.	Power Supply	Conrad	PS2403D	-
3.	Oscilloscope	Tektronix	TDS 1001B	-

Used Programs

Nr.	Name	Version
1.	Altium Designer	13
2.	Micro-Cap	11

1 Table of Contents

2 Tasks

Task of this laboratory exercise was to build a several RC-Oscillator Circuit.

1. Calculation
2. Setup and Realisation
3. Measurement of the V_{cc}-Dependency
4. Measurement (Time domain and FFT)
5. Calculation of the Total Harmonic Distortion (THD)

The following RC-Oscillator circuits were built.

- T-Filter Oscillator (Notch filter)
- Phase-Shifting-Oscillator

All Oscillators were provided with an unsymmetrical power supply.

$GND = 0\ V$
$V_{cc} = 15\ V$

The cut off frequency for all following calculations and setups was $f_G = 300\ Hz$.

3 T-Filter Oscillator (Notch filter)

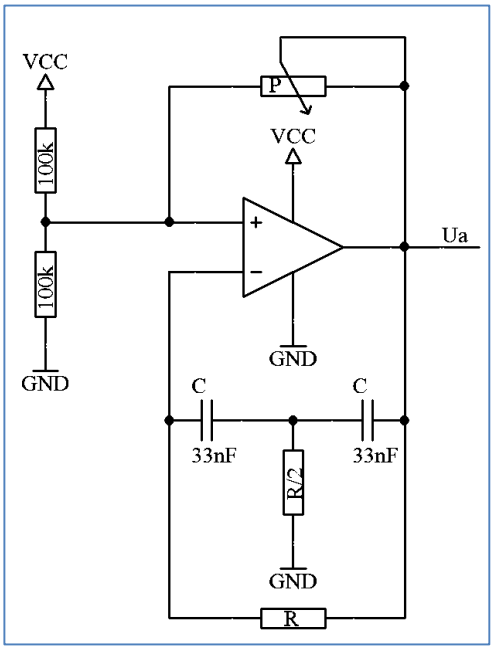
3.1 Calculations

Based on the given cut off frequency of 300 Hz the values for R and C were calculated. It was assumed that the capacitor hast a value of 33nF.

$$C = 33\ nF$$

$$f_g = \frac{1}{2 * \pi * R * C} \rightarrow R = \frac{1}{f_G * 2 * \pi * C} = \frac{1}{300\ Hz * 2 * \pi * 33\ nF} = 16\ k\Omega \rightarrow \text{R} = 15\ \text{k}\Omega$$

3.2 Measurement Circuit



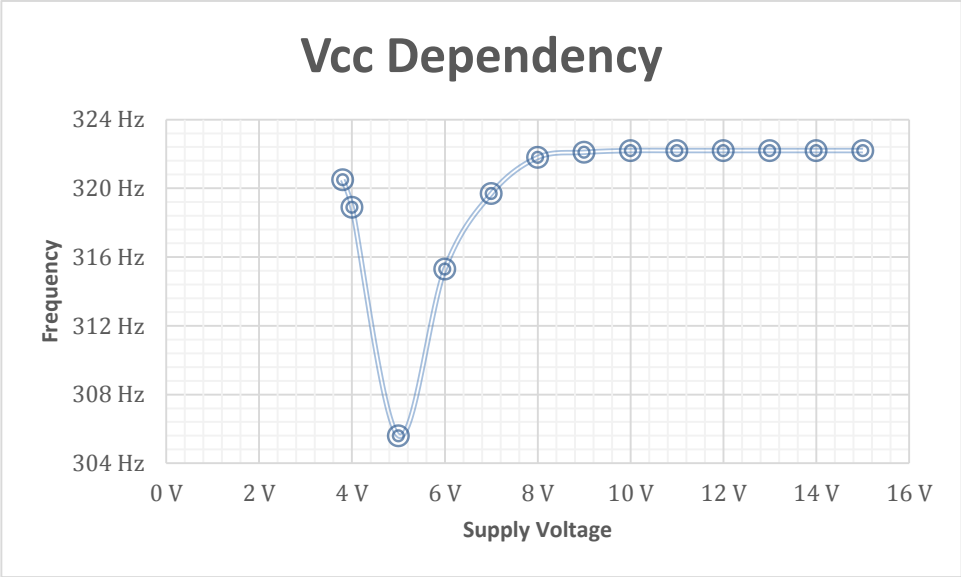
$R = 15\ k\Omega$

$\frac{R}{2} = 7.2\ k\Omega$

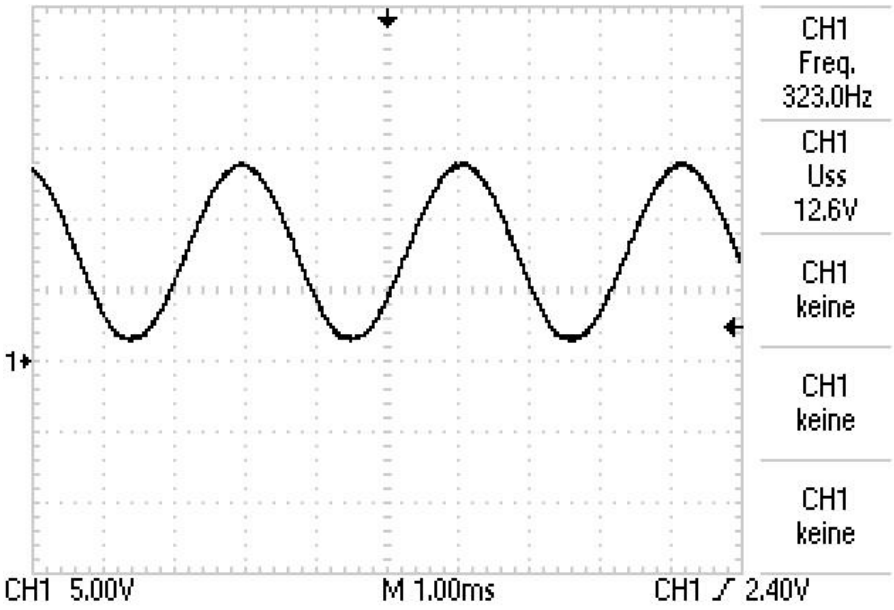
$P = 100\ k\Omega$

$C = 33\ nF$

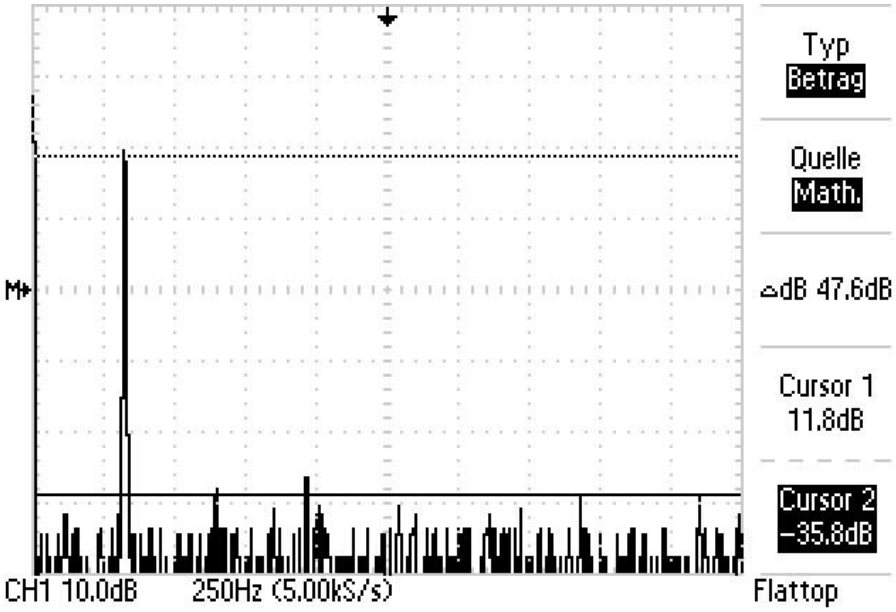
3.3 V_{cc} - Dependency



3.4 Measurement (Time Domain)



3.5 Measurement (FFT)



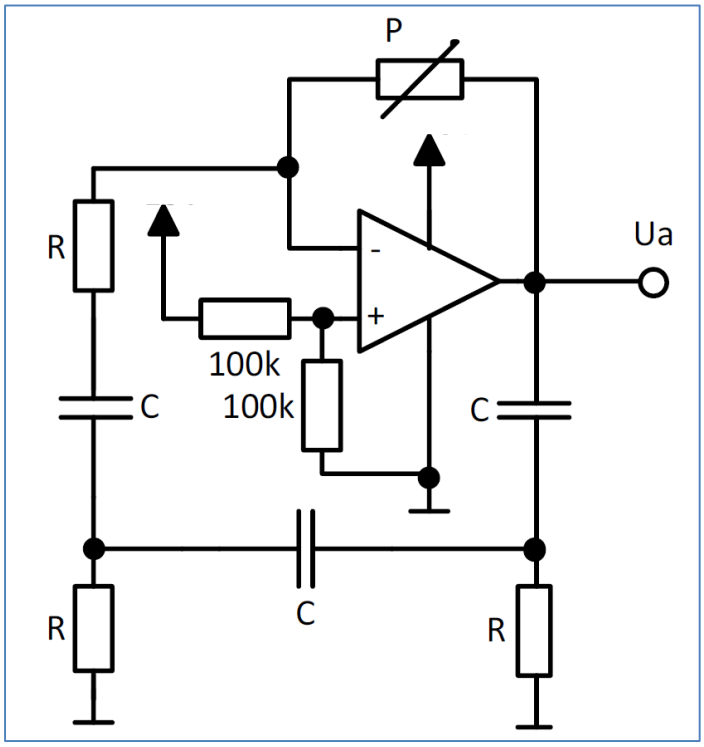
3.6 Total Harmonic Distortion

Based on above measurement (FFT) the difference between the cursors was taken for the following calculations. ($\Delta Cursor = 47{,}6\ dB$)

$$k = 10^{\frac{47{,}6\ dB}{20}} \cong 240 \rightarrow \frac{1}{240} = 4{,}16\ mV \rightarrow 14{,}16\ mV * \sqrt{2} = 5{,}88\ mV = 5{,}8\ \%$$

4 Phase-Shifting-Oscillator

4.1 Measurement Circuit



$R = 15\ k\Omega$

$\frac{R}{2} = 7.2\ k\Omega$

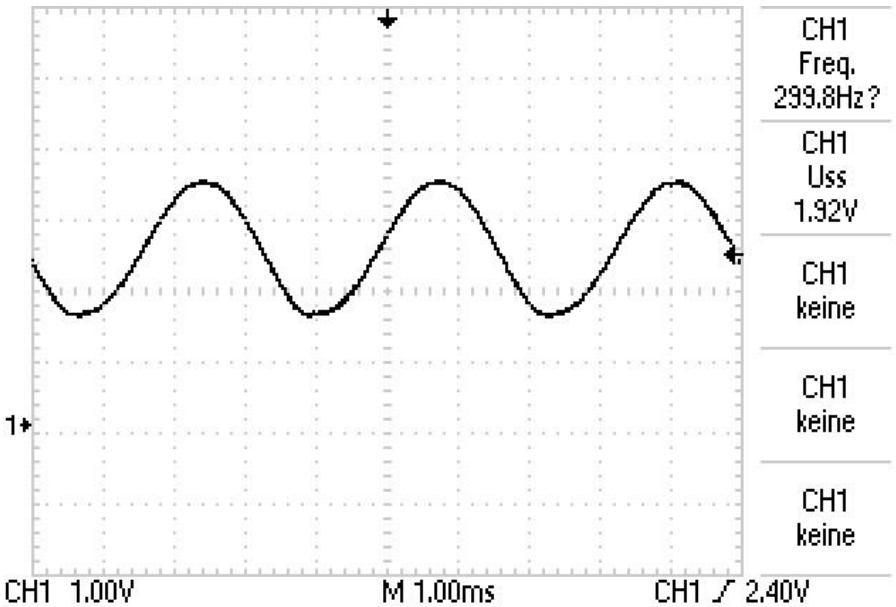
$P = 1\ M\Omega$

$C = 33\ nF$

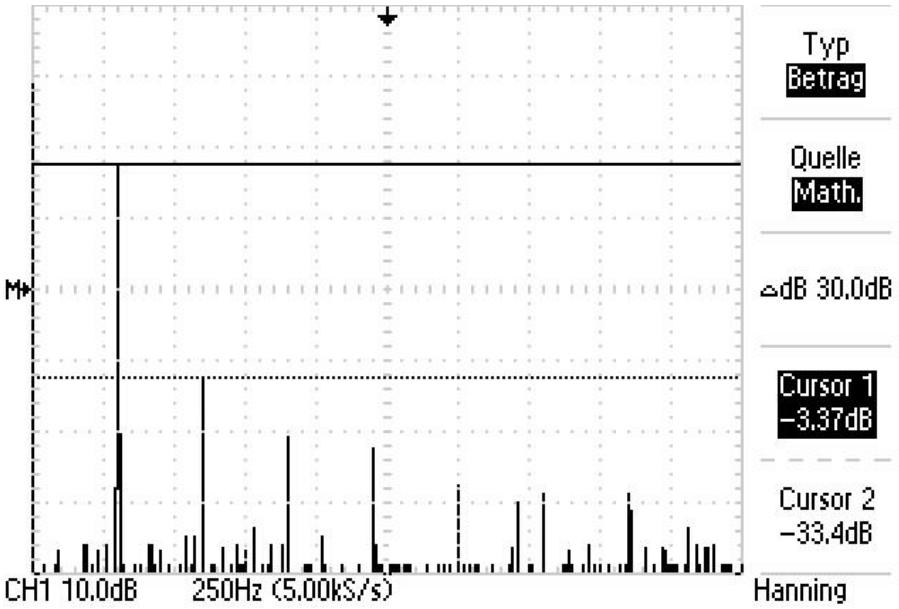
4.2 V_{cc} - Dependency

The oscillator frequency has not changed with a modified supply voltage.

4.3 Measurement (Time Domain)



4.4 Measurement (FFT)



4.5 Total Harmonic Distortion

Based on above measurement (FFT) the difference between the cursors was taken for the following calculations.

First Harmonic

$$\Delta Cursor\ 1 = 30\ dB$$
$$k = 4.5\ \%$$

Second Harmonic

$$\Delta Cursor\ 2 = 37\ dB$$
$$k = 1.9\ \%$$

Third Harmonic

$$\Delta Cursor\ 3 = 40\ dB$$
$$k = 1.4\ \%$$