Electronics Lab Course
Experiment #0: Introduction and Preparational Experiment

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Contents

1 Aims of the experiment

The aim of this experiment is to understand the tools used in the electronics lab course. In order to do so, the termini of bandwidth and ramp-up time are introduced.

2 Preperational exercises

2.1 0.2.1.A

$$\begin{aligned} U(t) &= U_0 \cdot \sin(\omega t) \\ U_{PP} &= 2 \cdot U_0 \\ U_P &= U_0 \\ U_{RMS} &= \frac{U_0}{\sqrt{2}} \end{aligned}$$

2.2 0.2.1.B

For a symmetrical rectangular voltage[1]

$$\begin{aligned} U_{RMS} &= \frac{U_0}{\sqrt{2}} \\ &= 7.07\,\mathrm{V} \end{aligned}$$

2.3 0.2.2.C

2.3.1 0.2.2.C.1

$$\begin{aligned} \text{To proof: } R_i &= \frac{U_2 - U_1}{I_1 - I_2} \\ U_n &= U_0 \frac{R_n}{R_n + R_i} \\ I_n &= \frac{U_n}{R_n} \\ \Leftrightarrow I_n &= U_0 \frac{1}{R_n + R_i} \\ U_2 - U_1 &= U_0 \left(\frac{R_2}{R_2 + R_i} - \frac{R_1}{R_1 + R_i} \right) \\ I_1 - I_2 &= U_0 \left(\frac{1}{R_1 + R_i} - \frac{1}{R_2 - R_i} \right) \\ \Rightarrow \frac{U_2 - U_1}{I_1 - I_2} &= \frac{\left(\frac{R_2}{R_2 + R_i} - \frac{R_1}{R_1 + R_i} \right)}{\left(\frac{1}{R_1 + R_i} - \frac{1}{R_2 + R_i} \right)} \\ &= \frac{R_2 (R_1 + R_i) - R_1 (R_2 + R_i)}{R_2 + R_i - R_1 - R_i} \\ &= \frac{R_i (R_2 - R_1)}{R_2 - R_1} \\ &= R_i \end{aligned}$$

[1] In this case with $U_P = 10\,\mathrm{V}$

2.3.2 0.2.2.C.2

$$\begin{aligned} U_0 &= 10\,\mathrm{V} \\ U_n(50\,\Omega) &= 5\,\mathrm{V} \\ U_n &= U_0 \frac{R_n}{R_n + R_i} \\ \Rightarrow R_i &= 50\,\Omega \end{aligned}$$

2.4 0.3.3.E

$$\begin{aligned} \text{To proof: } B\Delta t &= 0.35 \\ B &= \frac{1}{2\pi\tau} \\ \Delta t &= t(0.9U_0) - t(0.1U_0) \\ \text{Decharging-function of a capacitor: } U(t) &= U_0 \exp\left(-\frac{t}{\tau}\right) \\ \frac{0.1}{0.9} &= \exp\left(-\frac{\Delta t}{\tau}\right) \\ \Leftrightarrow \Delta t &= -\ln\left(\frac{1}{9}\right)\tau \\ &= 2.197\tau \\ \Rightarrow B\Delta t &= \frac{2.197}{2\pi} \\ &\approx 0.35 \end{aligned}$$

3 Procedure

3.1 0.4.1.a

Different signals at different frequencies and amplitudes shall be observed at the oscilloscope.

3.2 0.4.1.b

Δt of a rectangular voltage shall be determined by measuring the delay from $0.1U_0$ to $0.9U_0$ with the oscilloscope.[2]

[2]We must also pay attention to the bandwidth of the oscilloscope which is - so says the manual - 60 MHz

4 Measurement

4.1 0.4.1.a

4.2 0.4.1.b

5 Evaluation

6 Conclusion