

Electronics Lab Course

Experiment #1: Expansion of signals in conductors

Christopher Jörn

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1 Theoretical background

1.1 Conducting properties

If the electrical properties of a double-cable are equal on the whole cable, it is called homogeneous. In this experiment, we work with such cables.

Capacitive and inductive properties of the cable are:

$$C = \epsilon_r \epsilon_0 l \frac{2\pi}{\ln\left(\frac{r_a}{r_i}\right)}$$
$$L = \mu_r \mu_0 \frac{\ln\left(\frac{r_a}{r_i}\right)}{2\pi}$$

The four characteristics of a cable¹ grow proportional to it's length. A lossless cable can be approximated as a chain of many LC-links.

1.2 Expansion of waves in homogeneous cables

$$\frac{d^2}{dx^2}U - \gamma^2 U = 0$$
$$\gamma^2 = z' \cdot y' \Rightarrow \text{damping}$$

solution : $U(x, t) = U_f(x, t) + U_b(x, t)$ f: forward, b: backwards

$$I(x, t) = I_f(x, t) + I_b(x, t)$$

¹Resistance, inductance, capacity and loss

2 Preperational exercises

3 Experiment set-up

4 Procedure

5 Measurement

6 Evaluation

7 Conclusion