

Nonlinear resistors

Student Group

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All resistors examined so far are linear resistors, for which the characteristic curve $I=f(U)$ is a straight line, s. [figure 1](#). The resistance value of a linear resistor is independent of the current I flowing through it or the applied voltage U .



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Fig. 1: Characteristic curve of a linear resistor

With nonlinear resistors, there is no proportionality between current and voltage. The characteristic curve of such a resistor is shown in [figure 2](#). With these resistors, we talk about static resistance (R) and dynamic (or differential) resistance (r). The static resistance is determined for a specific operating point: at a specific voltage, the current is read from the resistance characteristic curve. The calculation is performed according to Ohm's law:

$$R = \frac{U}{I}$$

The differential resistance around the operating point is calculated from the current difference caused by a change in the applied voltage:

$$r = \frac{\Delta U}{\Delta I}$$



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Fig. 2: Characteristic curve of a nonlinear resistor

A light bulb is examined as an example of a nonlinear resistor. Set up the measuring circuit shown in [figure 3](#).



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Fig. 3: Measuring circuit light bulb

Set the voltage on the power supply to the voltage values from [table 1](#). Measure the corresponding current values and enter them in [table 1](#).



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Tab. 1: Values characteristic curve light bulb

Create the characteristic curve $I = f(U)$, s. [figure 4](#)



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Fig. 4: Characteristic curve light bulb

Calculate the static resistance R at the operating point $U = 7.0 \text{ V}$:

Calculate the dynamic resistance r at the operating point $U = 7.0 \text{ V}$:

Compare the values with the values from [table ##](#) (direct resistance measurement)

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