Nonlinear resistors

Student Group

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Table of Contents

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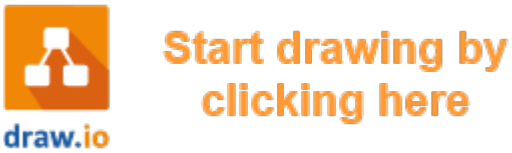
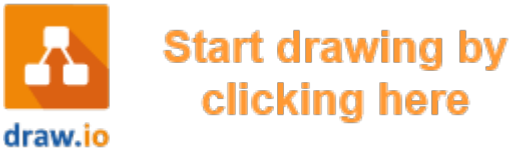
All resistors examined so far are linear resistors, for which the characteristic curve $I=f(U)$ is a straight line, s. figure 1. The resistance value of a linear resistor is independent of the current I

flowing through it or the applied voltage U.
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: $$ r = \frac{\Delta U}{\Delta I} $$
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.

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.

Tab. 1: Values characteristic curve light bulb

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

Fig. 4: Characteristic curve light bulb Calculate the static resistance R at the operating point $U = \rm 7.0 ~V$:

Calculate the dynamic resistance r at the operating point $U = \rm 7.0 ~V$:

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