

Practice 1

Topic: *Creating up mathematical models of a nonlinear part of a system*

You should make mathematical models (the mathematical description) of the following nonlinearities:

I. The mathematic description for the relay with saturation (fig. 1):

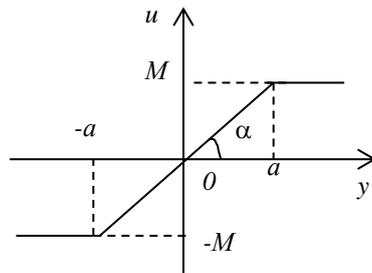


Fig. 1 – Relay with saturation

The mathematic description (fig. 1):

$$u = \begin{cases} +M, & y \geq a \\ ky, & -a < y < a, \\ -M, & y \leq -a \end{cases}$$

where $k = \operatorname{tg} \alpha = M/a$, “ k ” is slope coefficient; α , a and M are const.

II. The mathematical description for the relay with an insensitivity zone without saturation

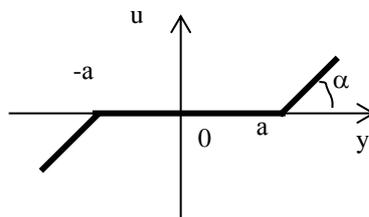


Fig. 2 – Relay with an insensitivity zone without saturation

The mathematical description:

$$u = \begin{cases} k(y - a), & y \geq a \\ 0, & -a < y < a, \\ k(y + a), & y \leq -a \end{cases}$$

Where $k = \operatorname{tg} \alpha$, $a - \text{const}$.

III. The mathematical description for the relay with saturation and with insusceptibility zone

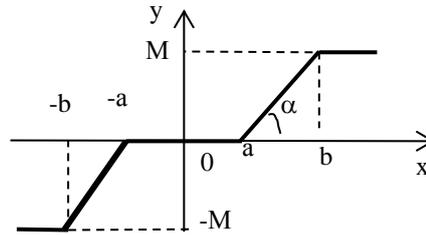


Fig. 3 – The relay with saturation and with insusceptibility zone

The mathematical description:

$$u = \begin{cases} +M, & y > b \\ k(y - a), & a < y < b \\ 0, & -a < y < a \\ k(y + a), & -b < y < -a \\ -M, & y < -b \end{cases},$$

where $k = \operatorname{tg} \alpha$; $a, b, M - \text{const}$.

Here the most widespread types of nonlinear characteristics of the nonlinear elements (NE) which make a nonlinear part (NP) of the studied systems are given.