VINNITSA NATIONAL AGRARIAN UNIVERSITY

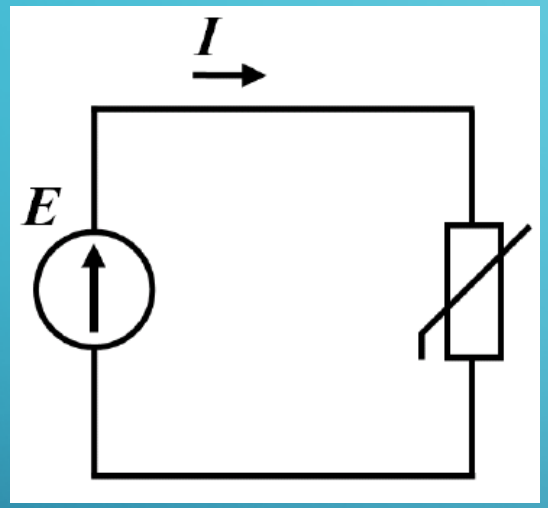
Department of General Engineering Sciences and Labour Safety

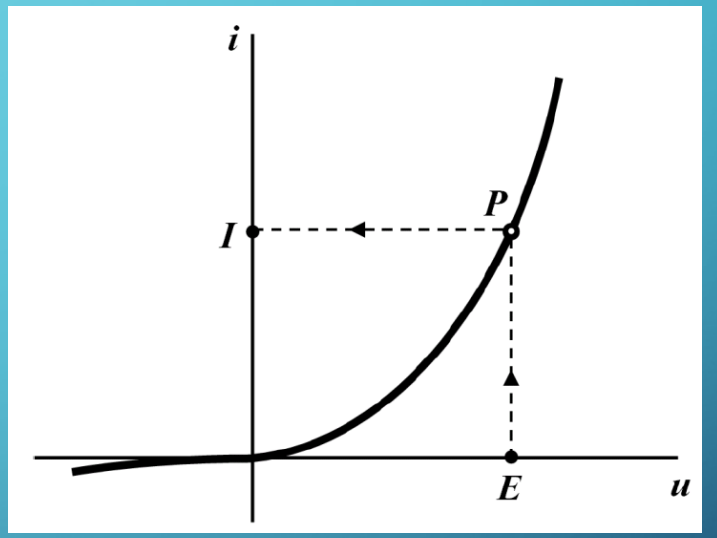
CALCULATION OF NONLINEAR ELECTRICAL CIRCUITS

by Associate Professor V. Hraniak

GRAPHIC METHOD

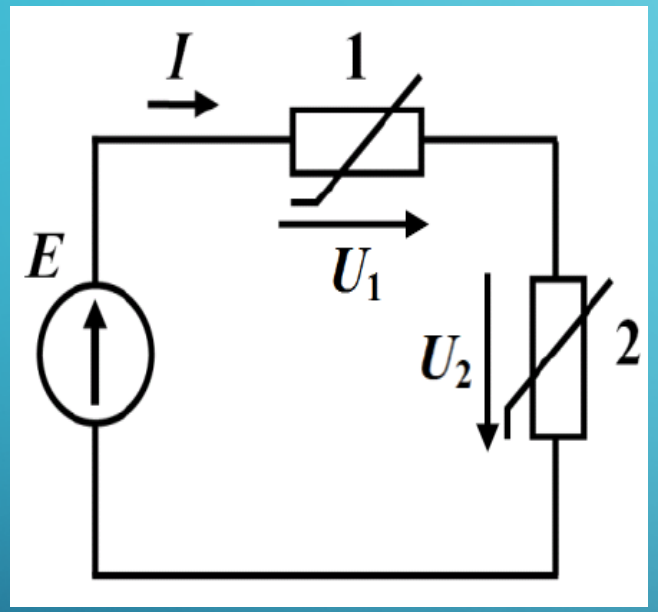
EXAMPLE 1. The simplest circle

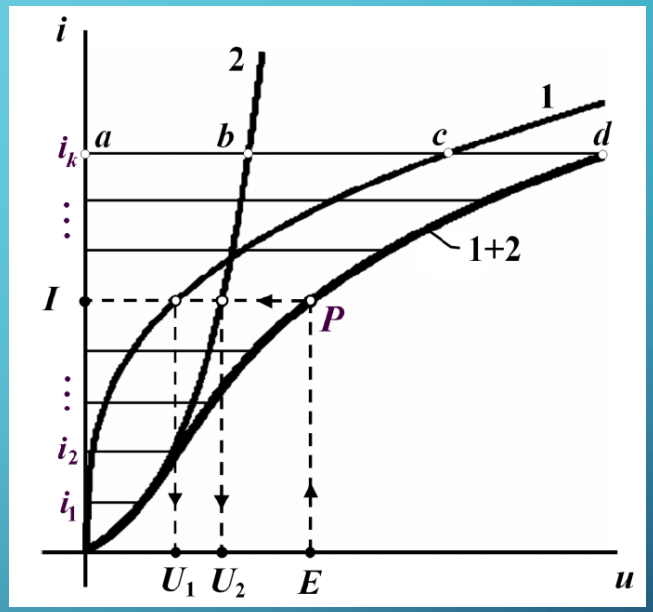




Volt-ampere characteristic

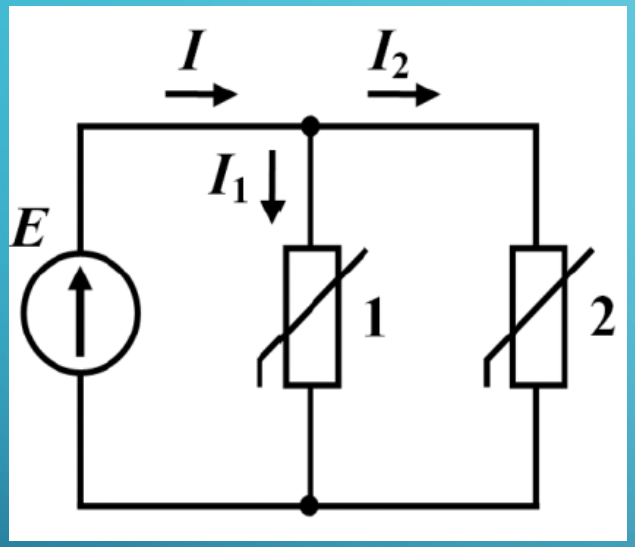
EXAMPLE 2. Serial connection

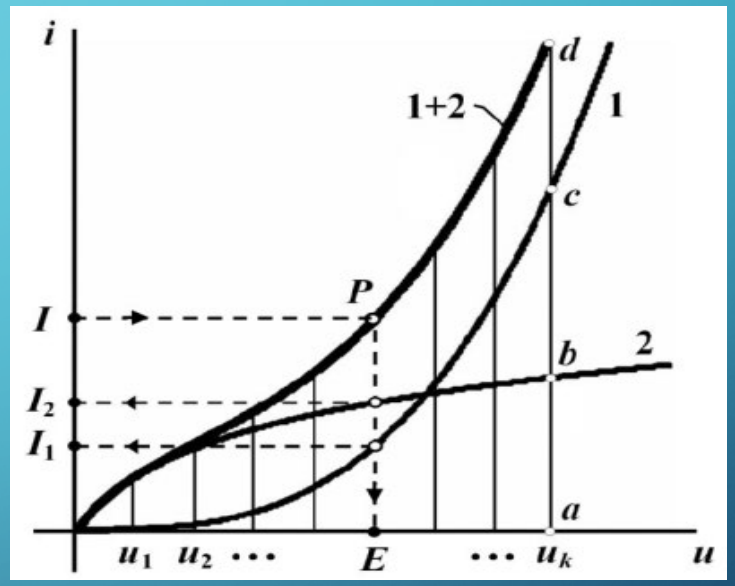




Volt-ampere characteristic

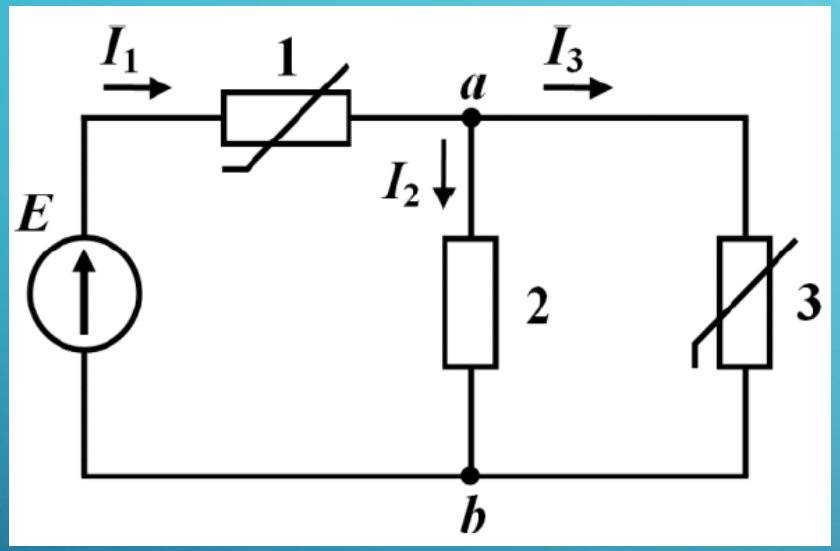
EXAMPLE 3. Parallel connection

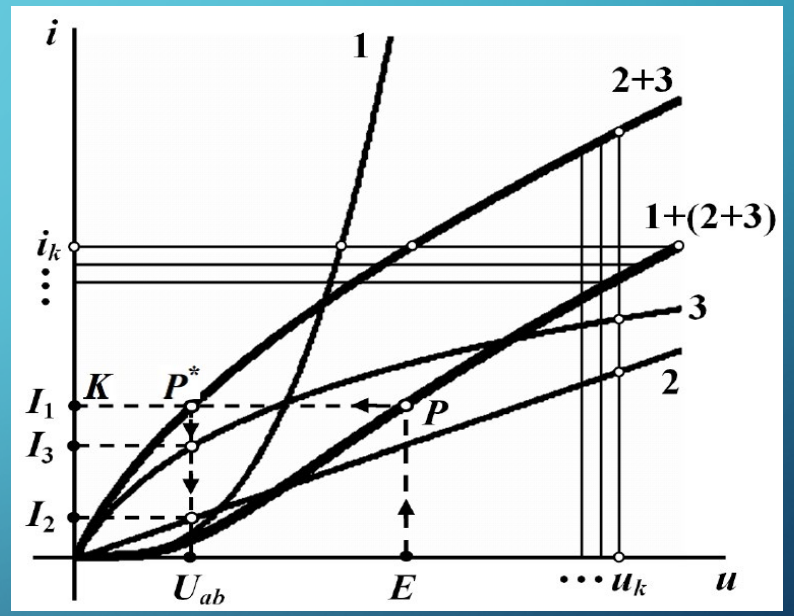




Volt-ampere characteristic

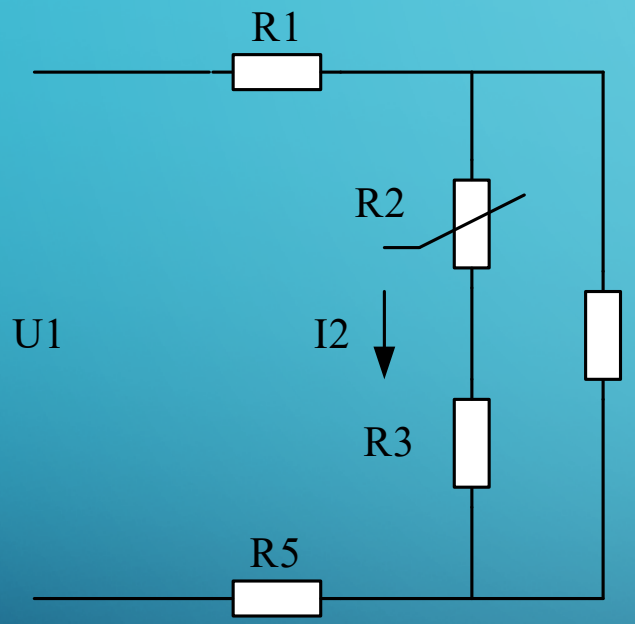
EXAMPLE 4. Branched circle



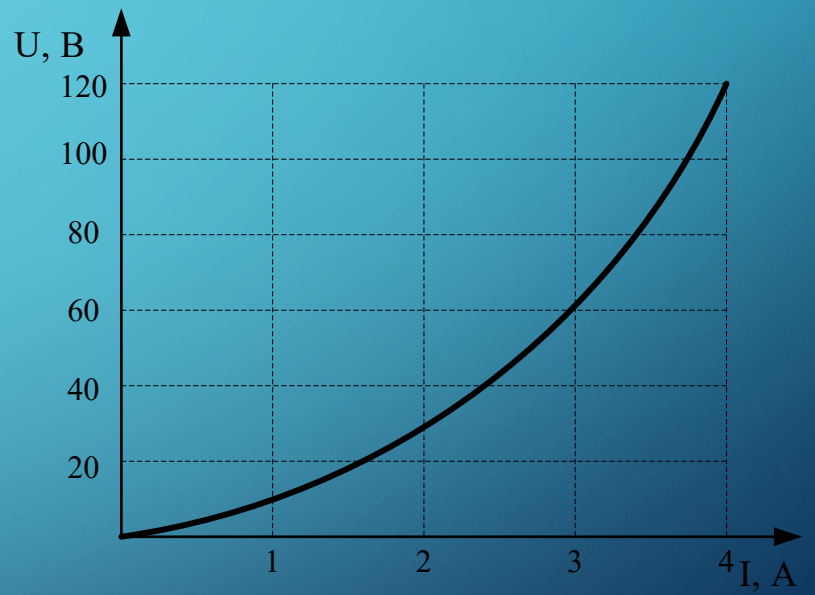


Volt-ampere characteristic

EXAMPLE FOR SELF-CALCULATION



U1 = 120 В
R1 = 40 Ом
R3 = 30 Ом
R4 = 40 Ом
R5 = 10 Ом



EQUIVALENT GENERATOR METHOD

If there is only one nonlinear element in a complex electric circuit, it is convenient to represent the whole linear section of this circuit with an equivalent generator.

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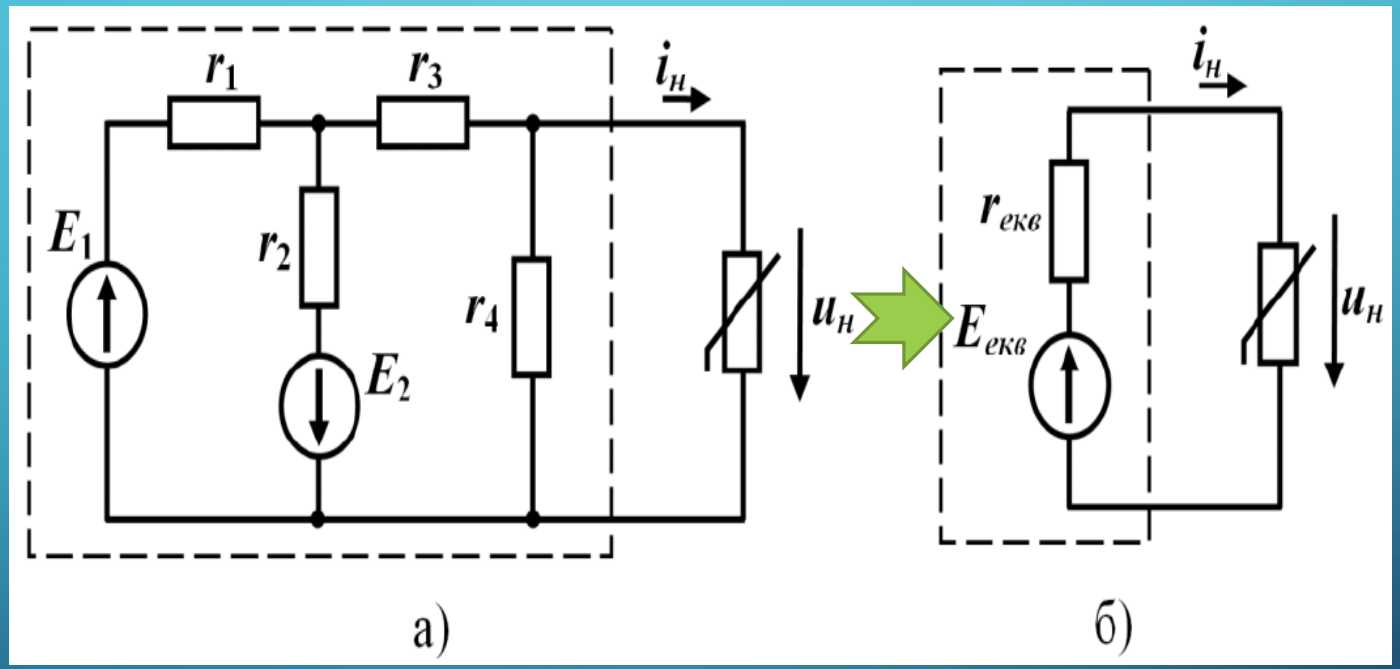
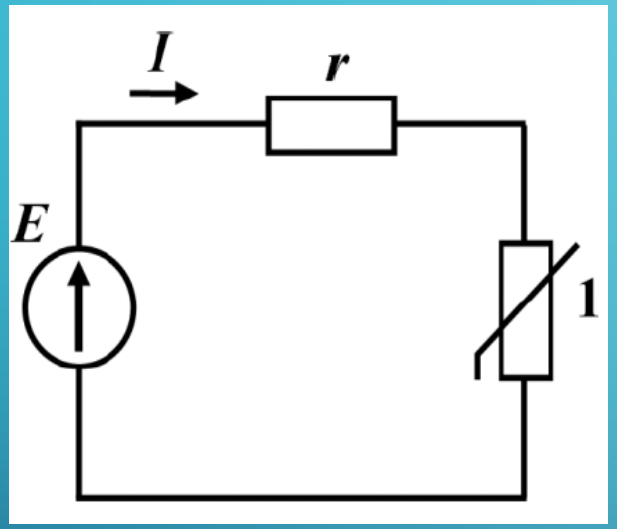
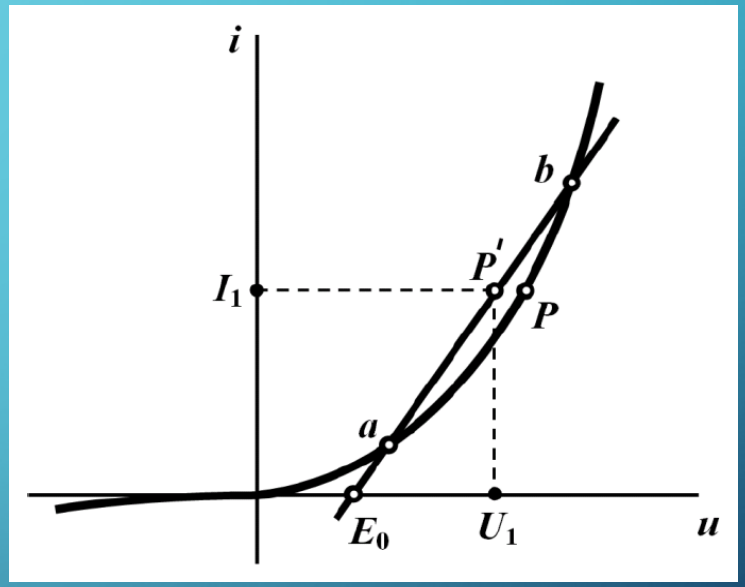


GRAPHO-ANALYTICAL METHOD

Grapho-analytical methods include combined methods of calculating nonlinear electrical circuits, in which the solution of the problem is sought mainly analytically, but in combination with the corresponding graphical constructions.

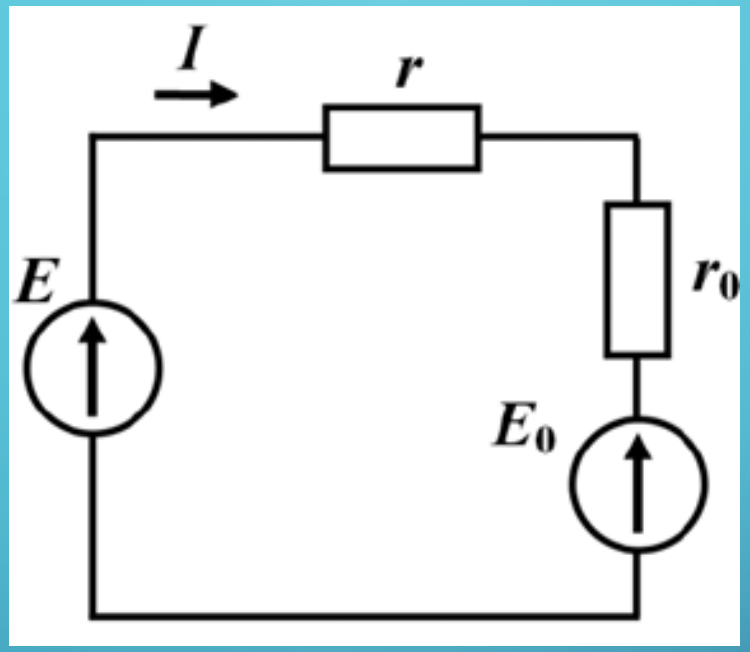




Volt-ampere characteristic of resistor 1 and its approximation

$$r_0 = \frac{U_1 - E_0}{I_1},$$

AS THE RESULT



$$I = \frac{E - E_0}{r + r_0},$$

After determining the current I need to check whether the found current is within the area ab of the characteristic. If so, the calculation is complete, otherwise you need to select a new section of linearization of the curve and repeat the calculation.

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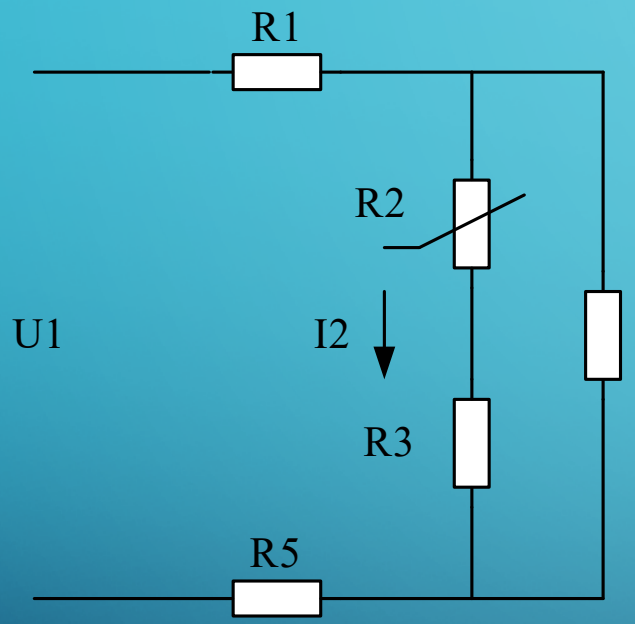

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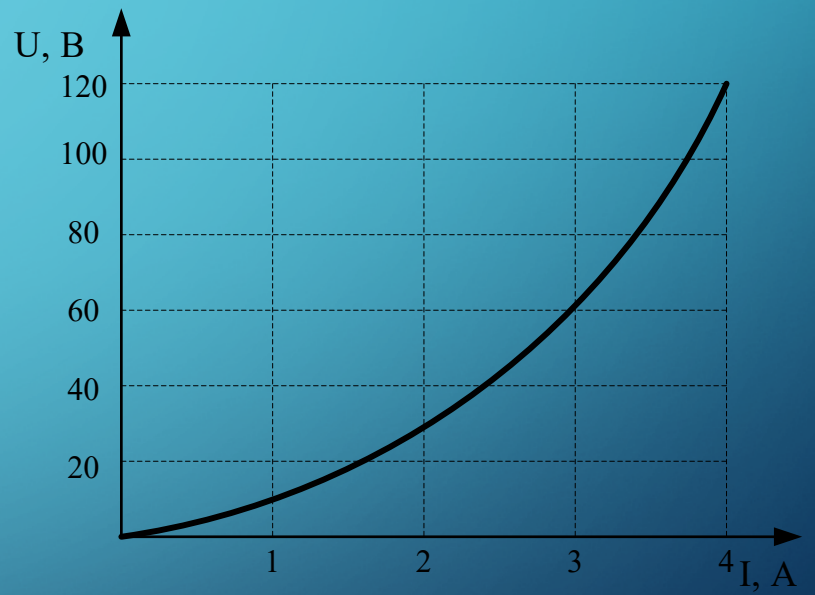

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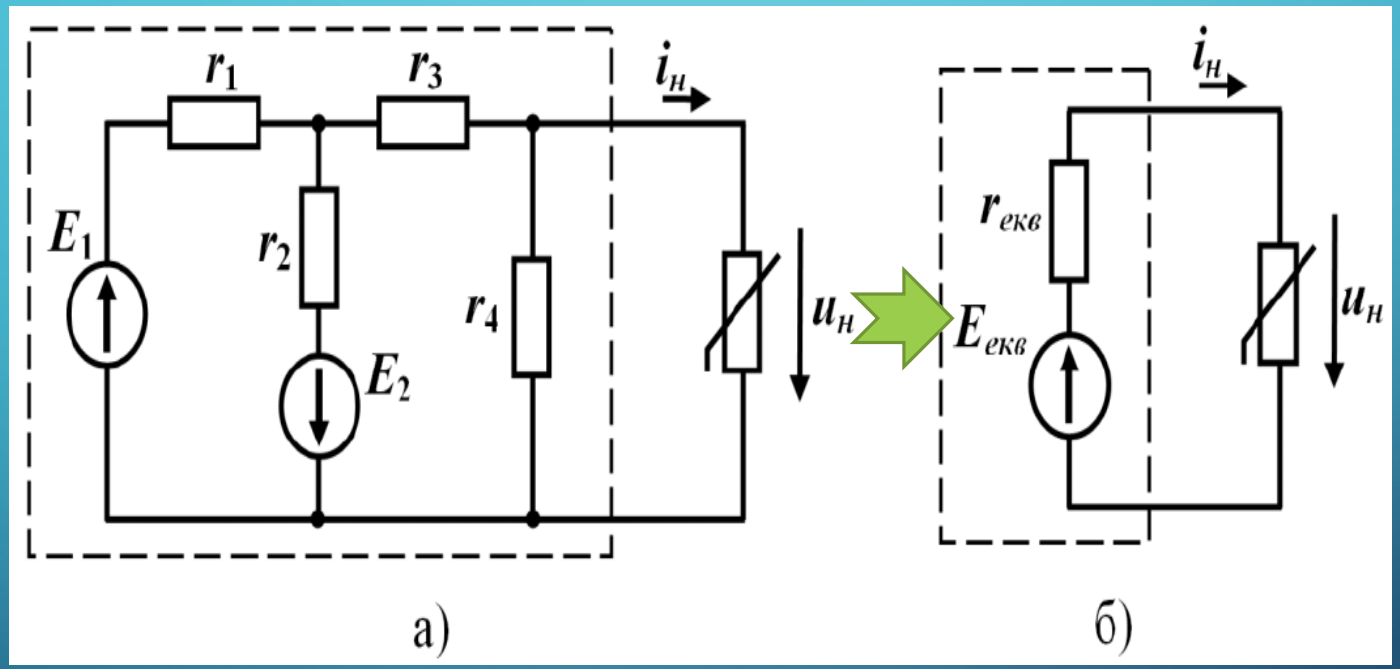

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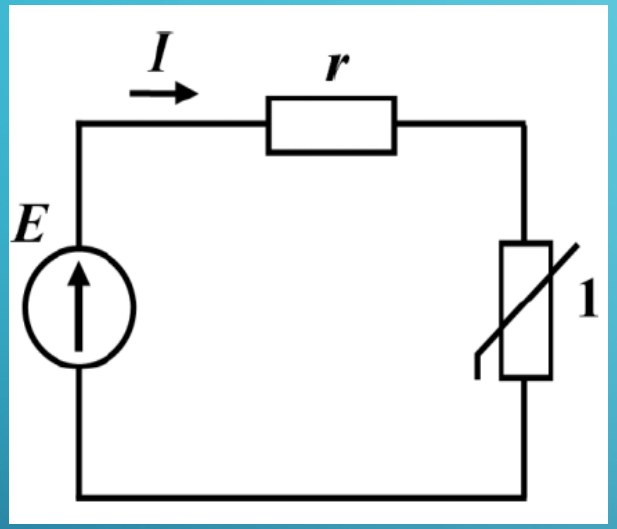

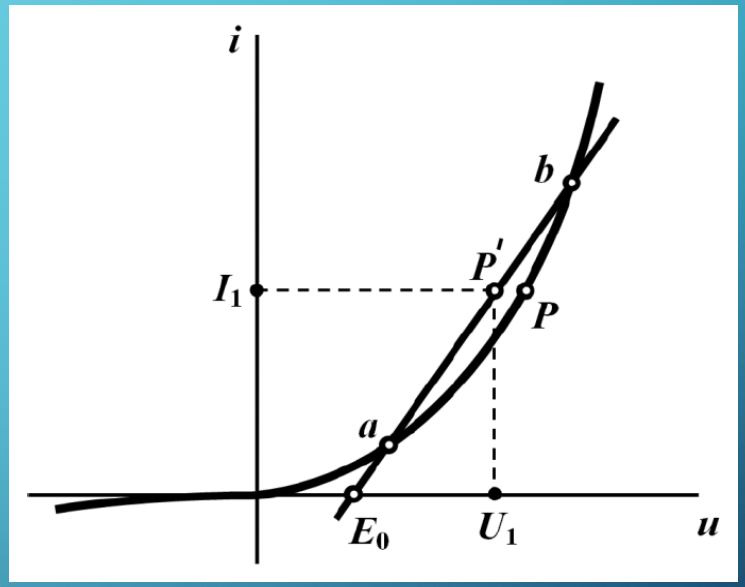

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