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A TECHNICAL–ECONOMICAL MODEL OF POWER CABLES

RAIMONDAS ČIEGIS, GERDA JANKEVIČIŪTĖ, MEČISLAVAS MEILŪNAS, OLGA SUBOČ

Vilnius Gediminas Technical University

Saulėtekio al. 11, LT-10223, Vilnius, Lithuania

E-mail: {rc, gerda.jankeviciute, mecislavas.meilunas, olga.suboc}@vgtu.lt

According to the standard IEC287 requirements the minimal cross-section area of the power cables is caused by three restrictions of technical nature:

1. Maximal temperature generated by rated current;
2. Voltage drop created by the maximum rated current;
3. Electrodynamic impact of the strongest short–circuit current.

However, cross-section (metal) area, obtained by taking into account these restrictions, usually is appropriate to guarantee a safe and good quality of energy supply, but it is too small in order to minimize the total cost of power cable usage during the long time period.

In the past years remarkable progresses have been made in understanding of this problem and in working out mathematical models, which include the economic dimension as well (see, [1; 2]).

The most important task in modelling the total costs, is to evaluate energy losses of power cable. Here we use our original software for calculation of heat transfer in power cables under different loads [3].

We propose the following mathematical model for optimization of conductor area size in order to minimize total cost of the usage of power cable during the time interval $[0, T]$:

$$\min_{S\in D}\left[(A(S)S + C)L + \frac{F}{S}\int_0^T I^2(t)\rho(S,t)\,dt\right],$$

where S is the conductor cross-section area, $I(t)$ the current value at the time moment t, $\rho(S,t)$ is the conductor resistance at the time moment t for a given cross-section size S, $A(S)S + C$ defines cost of installation, F gives a relation between operational and financial value [1].

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