OPTIMIZATION OF THE EQUIPMENT AGE STRUCTURE IN THE INTEGRAL MODELS OF RUSSIA'S POWER SYSTEMS DEVELOPMENT [1]

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In [1] consideration is given to the optimization problem of equipment lifetime of Russia's electric power systems. The phase variable $x(t)$ is the total electrical capacity put into operation at time t. It satisfies the nonclassical Volterra equation of the first kind

$$\int_{a(t)}^{t} K(t,s)x(s)ds = y(t), \quad t \in [t_0, T], \quad x(t) = x^0(t), \quad t \in [a(t_0), t_0), \tag{1}$$

where $K(t,s)$ is the efficiency factor of using at time t of the capacity unit commissioned earlier at time s; $y(t)$ is the dynamics of the available capacity given by expert; $t-a(t)$ is the lifetime of the oldest unit at time t; $x^0(t)$ is known dynamics of commissioning the capacity on $[a(t_0), t_0)$.

In [2] the modeling of the power systems development is based on the generalizing equation (1)

$$\sum_{i=1}^{n} \int_{a_i(t)}^{a_{i-1}(t)} K_i(t,s)x(s)ds = y(t), \quad t \in [t_0, T], \quad a_0(t) \equiv t, \quad a_n(t_0) \le t_0, \tag{2}$$

in which the i-th term corresponds to the i-th age group of the system elements, and properties of functions $a_i(t)$, $i = \overline{1,n}$, depend on the hypotheses assumed about the mechanism of the equipment aging.

In [1] the functional of total costs to commission new and repair and maintain the existing equipment for the $T - t_0$ (years) is used as an optimization criterion of selection of $a(t)$.

In development [1], [2], this paper considers the formulation of the optimal control problem with the same functional and integral constraint on the phase variable in the form (2), and can be optimizable functional parameters both a_i and K_i. Now we are developing a heuristic algorithm optimization of function $a_n(t)$, which determines the dynamics of removing for the older age group elements from service.

REFERENCES

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