Research (What is it about?)	**Parametric coefficient optimization in the global electric circuit equation**
UNN authors	*Chernov A.V.*
We find (The result)	For the problem of parametric optimization of the coefficient and the right-hand side of the linear global electric circuit equation, formulas for the first partial derivatives of an integral cost functional with respect to control parameters are obtained
Abstract	The problem of identification the unknown numerical parameters ν_1, ν_2 in senior coefficient and the right-hand side of the linear differential equation $\frac{\partial}{\partial t}\Delta\varphi(t,x)+4\pi\ \mathrm{div}\ \left(\sigma(x;\nu_1)\nabla\varphi(t;x)\right)=4\pi\ \mathrm{div}\ J^{ext}(t,x;\nu_2)$ is considered. The above equation is known as the global electric circuit equation (in the sense of electric fields distributed in the Earth's atmosphere, ***thunderstorm cloud*** for example). The unknown function is treated as a scalar electric potential φ, while $J^{ext}(t,x;\nu_2)$, as the volumetric density of external electric current. In practice, only certain parametric representations of the coefficient and the right-hand side are usually known, i.e. , $\sigma=\sigma(x;\nu_1)$ and $J^{ext}=J^{ext}(t,x;\nu_2)$, where the parameters ν_1, ν_2, are unknown. The problem of reconstructing the unknown parameters from observations can be represented (under certain conditions) as the minimization of an integral functional depending on φ, i.e., in fact, on the unknown parameters. To apply a numerical minimization method of the first order, one has to know the gradient of this function. Thus, the question arises of computing its partial derivatives with respect to ν_1, ν_2. The formulas for its calculation are obtained which contain the analytic solution of initial-boundary problem and conjugate one. The sufficient conditions are found for global (for all permissible set of ν_1, ν_2) solvability of this problem.

Representative articles 2016-2017, quartiles	1. *Chernov A.V.* Differentiation of a Functional in the Problem of Parametric Coefficient Optimization in the Global Electric Circuit Equation. Comput. Math. and Math. Phys. **56**(9), 1565-1579 (2016). 2. *Chernov A.V.* On a Majorant-Minorant Criterion for the Total Preservation of Global Solvability of Distributed Controlled Systems. Differential Equations. **52**(1), 111–121 (2016).	Q2,Q3 Q4
	Q-index (Qi) of the result	**1,75**

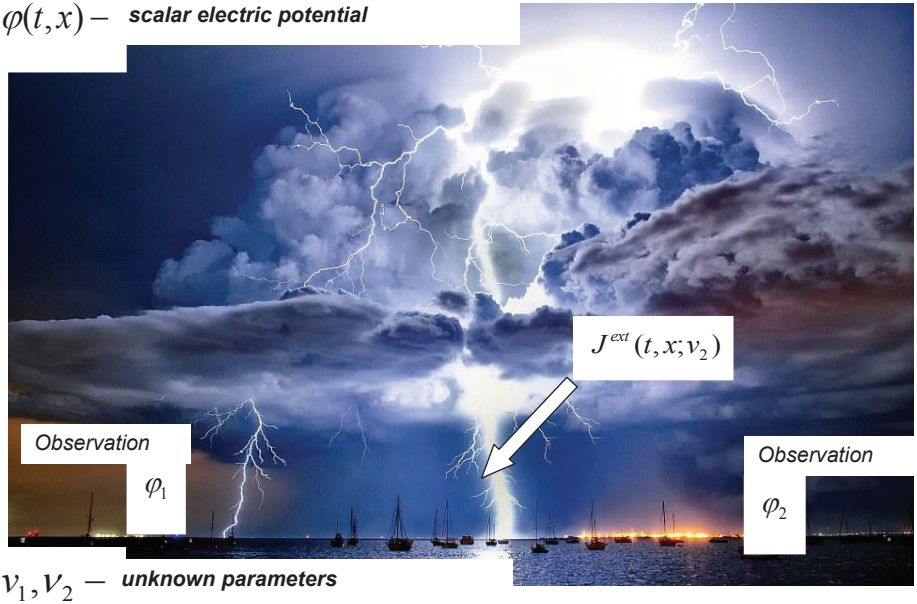
In collaboration	Nizhnii Novgorod State Tech Univ, Nizhnii Novgorod, Russia

The equation for electric fields distributed in the Earth's atmosphere:

$$\frac{\partial}{\partial t}\Delta\varphi(t,x)+4\pi\ \mathrm{div}\ \left(\sigma(x;v_1)\nabla\varphi(t;x)\right)=4\pi\ \mathrm{div}\ J^{ext}(t,x;v_2)$$

and search the entering parameters by the results of observation (minimization of an integral functional depending on φ):

$\varphi(t,x)$ — ***scalar electric potential***



v_1, v_2 — ***unknown parameters***

The cost functional in the parametric optimization problem:

$$J[v]=\int_0^T dt \int_\Omega F(t,x,\varphi[v](t,x),v)dx.$$