Fluid filtration in an inhomogeneous porous layer with permeability coefficient that varies according to a quadratic law

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The paper considers a model problem of fluid filtration in an inhomogeneous porous layer with the permeability coefficient which decreases with depth as the square of the distance to the bottom. We obtained exact solutions of the corresponding boundary value problems for two-dimensional and three-dimensional cases. As an example of applying the obtained formulas we give the solutions of filtering problems under the spot dam and a cascade of two spot dams in an inhomogeneous layer with aquiclude, the solutions being expressed in elementary functions. Moreover, we examined the source and the vertical well in the three-dimensional inhomogeneous layer. The velocity potential in these cases is recorded in the form of integrals of elementary functions. The solutions of the boundary value problems discussed in this article can be applied when considering the steady electrical and thermal fields in inhomogeneous media, in which, respectively, the dielectric constant and coefficient of thermal conductivity change according to a quadratic law.

Keywords: *fluid filtration, inhomogeneous porous layer, permeability coefficient, Laplace equation, Poisson equation, Dirichlet problem*

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