R-Functions and Nonlinear Galerkin Method for Solving the Nonlinear Stationary Problem of Flow around Body of Revolution

A. V. Artiukh [1], M. V. Sidorov [1] and S. M. Lamtyugova [2*]

[1] *Department of Applied Mathematics, Kharkiv National University of Radioelectronics, Kharkiv, Ukraine*
[2] *Department of Advanced Mathematics, O. M. Beketov National University of Urban Economy in Kharkiv, Kharkiv, Ukraine*

Abstract: In the paper the steady flow of viscous incompressible fluid around a body of revolution is considered. The mathematical model of the process under consideration is the external boundary value problem for the stream function. For solving this problem a numerical method is proposed. The method is based on the joint use of the R-functions by V.L. Rvachev and the nonlinear Galerkin method. With the help of the R-functions, the problem solution structure is constructed. The structure exactly satisfies all the boundary conditions of the problem and has the necessary behavior at infinity. To approximate the uncertain components of the structure, the nonlinear Galerkin method is used. A computational experiment was carried out for the problem of the flow around a sphere, two touching, and two jointed spheres at different Reynolds numbers.

Keywords: *steady flow; viscous incompressible fluid; external boundary value problem; stream function; R-functions method; nonlinear Galerkin method.*

Mathematics Subject Classification (2010): 65N30, 76D05, 76D17.

---

* Corresponding author: `mailto:maliatko@gmail.com`