New theoretical and applicative mathematical methods in the study of the fluids with free surfaces movement

Mircea Lupu[1,3], Cristian-George Constantinescu[2] and Gheorghe Radu[2]

[1] *Transilvania University of Brasov, Brasov, Romania;*
[2] *Henri Coanda Air Force Academy, Brasov, Romania;*
[3] *Academy of the Romanian Scientists, Bucharest, Romania*

e-mail: `gh.radu@gmail.com`

In the paper the authors presents new mathematical models and methods in the optimization of these phenomena with technical applications: the optimization of the hydraulic, a eolian turbine's blades or for the eliminating air pollutants and residual water purification; the actions hydro-pneumatics (robotics) to balance the ship in roll stability, optimizing the sails (wind powered) for extreme durability or propelling force, optimizing aircraft profiles for the drag or the lift forces, directing navigation, parachute brake, the wall, etc. The scientific results are accompanied by numerical calculation, integrating in the specialized literature from our country and foreign.

The inverse methods which lead to the Riemann-Hilbert boundary problems, and singular equation for the analytical functions. Here we solve the problems regarding of the fluids flow in the curvilinear obstacles presence, regarding of the profiles optimization for the minimal or maximal drag. The drag forces are expressed by the nonlinear integral operators and the extremum of the functionals is made by using the parametrical or the Jensen inequalities. The applications are for the aerodynamics profiles, brake deflectors, bow problems, wind turbines, ship sails, jets theory, etc.