Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Supercavitating flow past an elastic curvilinear hydrofoil[1] YURI ANTIPOV, Louisiana State University — A nonlinear inverse fluid-structure interaction problem is considered. The obstacle is a curvilinear elastic hydrofoil, and the cavity formed behind is modeled according to the single-spiral-vortex model by Tulin. First, the model for a rigid polygonal supercavitating hydrofoil is solved by the method of conformal mappings. The mapping function is expressed through the solutions of two Riemann-Hilbert problems. To identify the vertices of the polygon where the jets break away from the foil, the Brillouin-Villat separation condition is applied. The unknown parameters of the conformal mapping are computed on solving a system of transcendental equations. Next, by increasing the number of vertices of a regular N-polygon, the cavitation problem for a circular arc is solved, pressure on the foil is defined, and a boundary- value problem for a thin shell subject to normal loading is stated. The elastic problem is solved exactly for an arc with clamped ends, and the new hydrofoil profile is determined. Finally, a new cavitation problem for the deformed foil is stated and solved. Numerical experiments reveals the presence of two thin partial cavities near the foil ends.

[1]This work was funded by NSF through grant DMS0707724.

Yuri Antipov
Louisiana State University

Date submitted: 28 Nov 2010 Electronic form version 1.4