



ЮЖНЫЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ
Региональный математический центр
SOUTHERN FEDERAL UNIVERSITY
Regional Mathematical Center
<https://rmc.sfedu.ru/>, Rostov-on-Don, Russia

International scientific online seminar on Analysis, Differential Equations and Mathematical Physics

Coordinators: Prof. Alexey Karapetyants, Prof. Vladislav Kravchenko

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8 July 2021, 6 pm (GMT+3)

Free boundary problems and Riemann-Hilbert problems on Riemann surfaces

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We study free boundary problems of two-dimensional flow of an ideal fluid in a wedge around a vortex patch (Problem 1) and of a half-plane with n curvilinear inclusions when the body at infinity is subjected to antiplane shear and the stress field inside the inclusions is uniform (Problem 2). The boundaries of the vortex patch and the inclusions are unknown and have to be recovered. To determine them, we employ a method of conformal mappings from a multiply-connected slit domain onto the physical domain. The map associated with Problem 1 is expressed through the solution of a scalar Riemann-Hilbert problem on a symmetric torus, while, in general, Problem 2 leads to a vector Riemann-Hilbert problem on a symmetric genus- n hyperelliptic surface. In a particular case, the vector problem is decoupled. In the scalar cases, we introduce a new meromorphic analogue of the Cauchy kernel bounded at the two infinite points of the surface, solve the factorization problem and the associated Jacobi inversion problem, and describe the whole family of conformal mappings. In the vector case of the inverse problem of elasticity, we recast the vector Riemann-Hilbert problem as a system of singular integral equations on two-sided slits on a Riemann surface, reduce it to a complete singular integral equation on the surface and regularize it.

*Seminar website: <https://rmc.sfedu.ru/seminar>. The seminar uses Microsoft Teams online platform. Please send questions to pichugina@sfedu.ru (Olga Pichugina, scientific secretary).

The seminar is organized by the Regional Mathematical Center of the Southern Federal University in collaboration with Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University and the special Interest ISAAC-OTHA group in Operator Theory and Harmonic Analysis.

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