Alexander Vasil'ev

Univalent Functions in the Dynamics of Viscous Flows

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Abstract. The main goal of the paper is to apply methods of the theory of univalent functions to some problems of fluid mechanics. Our interest centers on free boundary problems. We study the time evolution of the free boundary of a viscous fluid in the zero- and non-zero-surface-tension models for planar flows in Hele-Shaw cells either with an extending to infinity free boundary or with a bounded free boundary. We consider special classes of univalent functions which admit an explicit geometric interpretation to characterize the shape of the free interface. The paper contains a survey part as well as new results. We also set up some new problems.

Keywords. Free boundary problem, conformal map, complex analysis, special univalent functions.

2000 MSC. Primary 30C45, 76S05, 76D99; Secondary 35Q35, 30C35.

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