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Two-dimensional Impinging Jets in Hydrodynamic Rotational Flows

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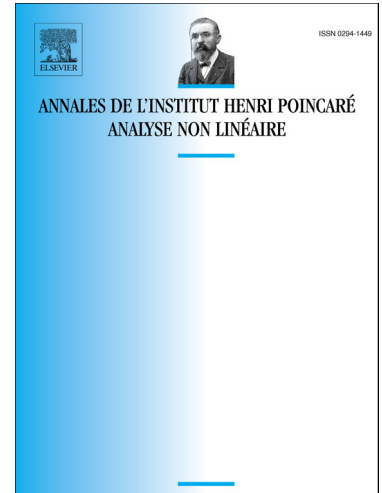
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**TWO-DIMENSIONAL IMPINGING JETS IN HYDRODYNAMIC
ROTATIONAL FLOWS***

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In Memory of Professor Yingming Liu

ABSTRACT. The free streamline theory in hydrodynamics is an important and difficult issue not only in fluid mechanics but also in mathematics. The major purpose in this paper is to establish the well-posedness of the impinging jets in steady incompressible, rotational, plane flows. More precisely, given a mass flux and a vorticity of the incoming flows in the inlet of the nozzle, there exists a unique smooth impinging plane jet. Moreover, there exists a smooth free streamline, which goes to infinity and initiates at the endpoint of the nozzle smoothly. In addition, asymptotic behavior in upstream and downstream, uniform direction and other properties of the impinging jet are also obtained. The main ingredients of the mathematic analysis in this paper are based on the modified variational method developed by H. W. Alt, L. A. Caffarelli and A. Friedman in the elegant works [1, 17], which has been shown to be powerful to deal with the steady irrotational flows with free streamlines.

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Key words: Impinging jet, incompressible flows, free boundary, existence and uniqueness, variational method.

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