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NUMERICAL SOLUTION OF QUADRATICALLY NON-LINEAR BOUNDARY VALUE PROBLEMS USING INTEGRAL EQUATION TECHNIQUES, WITH APPLICATION TO NOZZLE AND WALL FLOWS

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This thesis investigates numerically some problems of steady inviscid free-surface hydrodynamics using the integral-equation technique, with applications to nozzle and wall flows. The behaviour of a fluid at a free surface is governed by the quadratically non-linear Bernoulli equation. Plane flows bounded by polygonal or straight fixed plates and free streamlines, involving smooth and non-smooth detachments at the separation points, are formulated as singular integral equations. These are then discretised to yield a system of non-linear algebraic equations that are, in turn, solved by the tools of non-linear programming, especially Newton's method.

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