Abstract Submitted
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On plane submerged laminar jets WILFRIED COENEN, ANTONIO L SANCHEZ, University of California San Diego — We address the laminar flow generated when a developed stream of liquid of kinematic viscosity ν flowing along channel of width $2h$ discharges into an open space bounded by two symmetric plane walls departing from the channel rim with an angle $\alpha \sim 1$. Attention is focused on values of the jet volume flux $2Q$ such that the associated Reynolds number $Re = Qh/\nu$ is of order unity. The formulation requires specification of the boundary conditions far from the channel exit. If the flow is driven by the volume flux, then the far-field solution corresponds to Jeffery-Hamel self-similar flow. However, as noted by Fraenkel (1962), such solutions exist only for $\alpha < 129^{o}$ in a limited range of Reynolds numbers $0 \leq Re \leq Re_c(\alpha)$ (e.g. $Re_c \simeq 1.43$ for $\alpha = \pi/2$). It is reasoned that an alternative solution, driven by a fraction of the momentum flux of the feed stream, may also exist for all values of Re and α, including a near-centerline Bickley jet, a surrounding Taylor potential flow driven by the jet entrainment, and a Falkner-Skan near-wall boundary layer. Numerical integrations of the Navier-Stokes equations are used to ascertain the existence of these different solutions.

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