

A MONOTONE ITERATION FOR AXISYMMETRIC VORTICES WITH SWIRL

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ABSTRACT. We consider steady, inviscid axisymmetric vortex flows with swirl in a bounded channel, possibly with obstacles. Such flows can be obtained by solving the non-linear equation

$$(1) \quad -\frac{\partial^2 \psi}{\partial z^2} - r \frac{\partial}{\partial r} \left(\frac{1}{r} \frac{\partial \psi}{\partial r} \right) = r^2 f(\psi) + h(\psi)$$

where f and h are given functions of the stream function ψ , with ψ prescribed on the boundary of the flow domain. We use an iterative procedure to prove the existence of solutions to this Dirichlet problem under certain conditions on f and h . Solutions are not unique and relations between different families of solutions are obtained. These families include not only vortex rings with swirl, but also flows with tubular regions of swirling vorticity as occur in models of vortex breakdown.

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