Theoretical models for compressible vortex streets

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Vortex streets are a common feature of fluid flows at high Reynolds numbers and their study is now well developed for incompressible fluids. Much less is known, however, about compressible vortex streets. A fundamental reason appears to be the inapplicability of the point vortex model to compressible flows. In this talk, we discuss point vortices in the context of weakly compressible flows and elaborate on the problems involved. We then adopt the hollow vortex model where each vortex is modelled as a finite-area constant pressure region with non-zero circulation. For weakly compressible flows steady hollow vortex solutions are well known to be candidates for the leading order solution in a perturbative Rayleigh-Jansen expansion of a compressible flow. Here we give details of that expansion based on the vortex street solutions of Crowdy & Green (2012). Physical properties of the compressible vortex streets are described. Our approach uses the Imai-Lamla method coupled with ana lytic function theory and conformal mapping. (Joint work with Darren Crowdy).