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On relation between scalar interfaces and vorticity in inviscid flows O.N. RAMESH, SAURABH PATWARDHAN, Indian Institute of Science Bangalore — A great variety of applications like pollutant mixing in the atmosphere, mixing of reactants in combustion highlight the importance of passive scalar dynamics in fluid flows. The other dynamically important variable in the study of fluid flow is the vorticity. Vorticity though, unlike a passive scalar, does affect the fluid motion. The dynamics of scalar (linear) and vorticity (non-linear) are governed by the equations which inherently have different characteristics. This paper addresses the question of the faithfulness of representation of vorticity by scalar marker and the motivation for this comes from the experiment of Head and Bandyopadhyay (1981) which showed the existence of coherent vortices by using smoke flow visualization in a turbulent boundary layer. We will show analytically in regions where the molecular diffusion effects are negligible, the vorticity and scalar gradients are orthogonal to each other. The iso- surface of scalar follows the vorticity in an inviscid situation. Also, we will demonstrate that in the case of unsteady burgers vortex and vortex shedding behind a finite circular cylinder, the scalar gradient is orthogonal to vorticity and inner product of vorticity and scalar gradients is zero in regions away from the wall.

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