Uniqueness of vortex patches and vortex helices for the incompressible Euler equations with application to stability

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摘要：We investigate rigidity properties of concentrated vortices for the incompressible Euler equations by using an approach involving refined estimates of stream functions and linearization of contour dynamics equations. To illustrate our ideas, we first analyse rotating vortex patches for the 2D incompressible Euler equations. Specifically, we prove that highly concentrated vortex patches in the unit disk must be either a small disk centered at the origin or the unique perturbed small disk rotating around the origin. Then we apply our method to establish rigidity results for traveling-rotating vortex helices near a helical vortex filament for the 3D incompressible Euler equations. As an application of our rigidity results, we further obtain orbital stability of these rotating vortex patches and traveling-rotating vortex helices.

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