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Quantifying the reconnection process of two vortices[1] GUILLAUME BEARDSELL, U. Laval, Canada, LOUIS DUFRESNE, ETS, U. Quebec, Canada, GUY DUMAS, U. Laval, Canada — In this work, we use DNS to study the reconnection of two vortices. The Navier-Stokes equations are solved using a Fourier pseudospectral algorithm with triply periodic boundary conditions. The zero-circulation constraint, which was found to be problematic by Pradeep & Hussain (2004), is circumvented by solving the governing equations in a proper rotating frame. To quantify the reconnection of two vortices, an approach using vortex filaments is considered. This approach is first validated against the results of Hussain & Duraisamy (2011) for two parallel counter-rotating vortices. In this latter case, symmetries in the initial flow provide a simple way to compute the instantaneous rate of reconnection. Next, we study the interaction of orthogonal, unequal strength vortices for which only partial reconnection can occur. Typically, the weak vortex (Γ_2) is seen to deform and wrap itself around the strong one (Γ_1) to (partially) reconnect. For Reynolds numbers (Γ_1/ν) of the order of 10^3 and circulation ratios $0.1 \leq \Gamma_2/\Gamma_1 \leq 0.9$, we compute the instantaneous reconnection rate and observe the propagating vorticity structures. Particularly, we look at some of the topological features that can be well visualized with vortex filaments.

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