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A highly adaptive three dimensional hybrid vortex method for inviscid flows DAN LUCAS, University of Bristol, DAVID G. DRITSCHEL, University of St Andrews — Motivated by outstanding problems surrounding vortex stretching (e.g. explosive vorticity growth, equation regularity and associated nonlinear depletion), a new hybrid vortex method for inviscid, three-dimensional, incompressible flows is presented. Special emphasis on spatial adaptivity is given to resolve as broad a range of scales as possible in a completely self-similar fashion. We discretise vorticity in Lagrangian filaments (space curves) and compute velocity on an adapted finite-volume grid. This allows for a two-fold adaptivity strategy. First, although naturally spatially adaptive by definition, the vorticity filaments undergo "renoding"; nodes are redistributed along the filaments to concentrate their density in regions of high curvature. Secondly the Eulerian mesh is adapted to follow high strain by determining resolution by way of local filament dimensions. These features allow vortex stretching and folding to be resolved in a completely automatic and self-similar way, in addition the filaments present themselves as a candidate for novel flow diagnostics. Validation of the method is demonstrated via relatively recently discovered helical vortex equilibria (Lucas & Dritschel 2009).

Dan Lucas
University of Bristol

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