JOURNAL OF COMPUTATIONAL PHYSICS 93, 485 (1991)

Note

The Fast Adaptive Vortex Method

In [1] we introduced a new numerical method for calculating two-dimensional incompressible flows represented by patches of constant vorticity. We demonstrated the versatility and robustness of our algorithm in [1, 2]. The algorithm works extremely well in calculating the evolution of patches with long fingered regions as shown in [1]. It calculates the velocity induced by the patch by approximating the area enclosed by the boundary of the patch directly, rather than by approximating it with an integral over the boundary. When a patch develops long boundaries which enclose a small area, methods which are based on integrals of the boundary are difficult to implement in such a way as to not introduce spurious numerical effects.

In [2] we reported the formation of a singularity in finite time in the boundary of a patch of constant vorticity. Subsequently in [3] it was reported that a singularity does not form, but that the contour remains smooth for all times. After refining the calculations upon which we based our conjecture in [2], we can still not state definitely whether or not a singularity forms. Determining the existence of singularities numerically is difficult. Whether a quantity is becoming extremely large or infinite is impossible to determine with absolute certainty no matter what numerical method one uses to perform the calculation.

REFERENCES

1. T. F. BUTTKE, A fast adaptive vortex method for patches of constant vorticity in two dimensions, *J. Comput. Phys.* **89**, 161 (1990).
2. T. F. BUTTKE, The observation of singularities in the boundary of patches of constant vorticity, *Phys. Fluids A* **1**, 1283 (1989).
3. D. G. DRITSCHEL AND M. E. MCINTYRE, Does contour dynamics go singular? *Phys. Fluids A* **2**, 748 (1990).

RECEIVED: March 23, 1990; REVISED: December 1, 1990

THOMAS F. BUTTKE
Courant Institute of Mathematical Sciences
New York University
251 Mercer Street
New York, New York 10012

0021-9991/91 $3.00