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The growth of a localized vortex in a plane stagnation flow JACOB COHEN, JIMMY PHILIP, Faculty of Aerospace Engineering, Technion, Haifa — The evolution of a finite amplitude 3D localized disturbance, having an initial dipole Gaussian vorticity distribution, embedded in an external, unbounded, irrotational plane stagnation flow ($\mathbf{U} = (Ay, Ax, 0)$) is investigated. Using the fluid impulse integral as a characteristic of such a disturbance, the viscous vorticity equation is integrated analytically. Accordingly, except for the specific case where the initial vortex is placed along $x = -y$, the associated fluid impulse decays and grows exponentially along the principal axes $x = y$ and $x = -y$, respectively. Numerical simulations, carried out for both linear and nonlinear disturbances at a Reynolds number of 40, confirm the above predictions. The simulations have been also compared with the solution of the linear viscous vorticity disturbance equation.[1] While the solution predicts the vorticity distribution for the linear case, it fails to predict the essential characteristics of a nonlinear disturbance associated with its self induced movement. Finally, it is shown that the fluid impulse and the disturbance kinetic energy follow the same trend, i.e. when the fluid impulse increases with time so does the kinetic energy and vice-versa. The correlation between them suggests the use of the fluid impulse to predict the stability for a localized disturbance.

[1]Leonard, A. 2000 *Turbulence Structure and Vortex Dynamics* Cambridge University Press

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