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The development of a buoyant vortex (thermal) in stationary and plane stagnation flows[1] GALI ALON, JIMMY PHILIP, JACOB COHEN, Technion, Faculty of Aerospace Engineering — The evolution of a buoyant vortex (thermal) in stagnant and irrotational plane stagnation flows is studied using both computational and theoretical tools. The relative effect of external shear is explored through the ratio between the two relevant time scales associated with the shear and buoyancy (viscous and diffusive effects, although included, are considered to be relatively small). An important effect of the stagnation base-flow is the earlier penetration of the ambient fluid into the buoyant mass, causing the formation of a buoyant vortex ring. Consequently, the growth of circulation ceases earlier resulting in a lower value of the maximum circulation. The initial growth rate of the circulation is theoretically predicted to be proportional to the density difference and the vertical extension along the structure's symmetry line. In an attempt to describe the time development of the circulation, a simple Lagrangian model is proposed, and its results agree with the numerical ones. Finally, theoretical analysis verified numerically, shows that the fluid impulse grows linearly or exponentially in stationary fluid or in plane stagnation flow, respectively.

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