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Similarity in 2-D spatially developing and long shear layers C. CARTON DE WIART, G. WINCKELMANS, C. BAILLY, P. CHATELAIN, Universite catholique de Louvain (UCL) - iMMC, F. THIRIFAY, Cenaero, A. RHOSKO, Caltech — 2D shear layers are studied using a high accuracy vortex-in-cell (VIC) method. The case investigated is $U_2/U_1 = 0.38$, as in the Brown and Rhosko experiment. The inflow corresponds to a regularized vortex sheet with momentum thickness $\theta_0 = \pi/4$ and $Re_0 = 54$. It then growths and smoothly undergoes transition, through TS waves and then K-H instabilities, to a "turbulent shear layer" developed at $x \approx 500$. Two computational domains are used: $L_1 = 2500$ and $L_2 = 3500$. Various outflow conditions are also used with L_1. We focus on self-similarity: profiles of U/U_1, $-\overline{u'v'}$, etc. as a function of $\eta = y/(x - x_0)$ (with x_0 virtual origin), and slopes $d\theta/dx$, etc. The results of the L_1 simulations agree well with each other; the region $x \in [1800, 2500]$ being affected by the outflow and thus dismissed. They also agree well with the results of the L_2 simulation, thus confirming the L_1 simulations validity. The region $x \in [2800, 3500]$ is dismissed in the L_2 simulation. A remarkable result is that we do not obtain one long region of self-similarity but, instead, multiple such regions: the region $x \in [900, 1200]$ with $d\theta/dx = 0.0180$ and $-\overline{u'v'}_{\max}/(\Delta U)^2 = 0.0135$, then the region $x \in [1400, 1900]$ with 0.0146 and 0.0115, then the region $x \in [2100, 2600]$ with 0.0177 and 0.0140 (thus almost identical to the first region, potentially hinting at a recurring pattern).

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