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Combined Vorticity Confinement and Total Variation Diminishing Technique for Modeling of Blade Tip Vortex[1] ALEX POVITSKY, KRISTOPHER PIERSON, University of Akron — The Vorticity Confinement (VC) approach is combined with Total Variation Diminishing (TVD) technique to avoid over-confinement and divergence of upwind second-order of approximation schemes. The TVD schemes were combined with the first (constant confinement parameter ε) and second (constant unit-less confinement parameter c) VC formulations and with adoptive VC formulation by Hahn and Iaccarino. Combined VC/TVD techniques were first applied to convected Taylor vortex, which represent a model of wing tip vortex. For the former two VC methods combination of the second-order upwind discretization scheme with VC shows significant over-confinement of vortex whereas the first-order discretization scheme leads to strong dissipation of vortex. While the latter VC technique shows acceptable results for first-order upwind scheme, it either diverges or strongly over-confines when the second-order upwind discretization scheme is used. The VC/TVD techniques were tested with non-differentiable minmod and Van Leer flux limiters and with differentiable Van Albada limiter. The combination of VC and TVD with differential limiter computes most accurate vortex. The proposed technique is applied to tip vortex generated by rotating blade. Implementation of combined VC with TVD equipped with differential flux limiter to CFD code FLUENT shows much more close comparison to experimental results in terms of vortex velocity profile and size of vortex core compared to the same CFD code without VC approach.

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