We believe the dispersion of the vorticity accomplished by jet injection in the present study is quite different from the phenomenon of vortex breakdown. In the vicinity of a highly loaded wing tip the tangential and axial velocities in the vortex core are of the same order of magnitude. Under this condition the vortex appears quite stable and thus persists far downstream. Vorticity diffusion can be enhanced by either sufficiently increasing or decreasing the core axial velocity. If the core axial velocity is sufficiently decelerated it is possible for downstream turbulence to propagate upstream via inertial waves to dissipate the core. Vortex breakdown represents the boundary of this upstream propagation. On the other hand, when the axial velocity is increased to be sufficiently larger than the tangential velocity, the core behaves as a turbulent jet and thus spreads relatively quickly. This latter type of diffusion is what appears to be taking place in the present experiment.

Conclusions

The present investigation demonstrates that axial injection into the core of a vortex can indeed beneficially spread out the vorticity concentrated in it and prematurely age it. It further shows that the phenomenon is more nearly governed by the momentum flux of injection than by mass flow. A suitable value of injection for which substantial changes are produced in the vortex core appears to correspond to α of roughly 0.35. Despite the relatively high value of α needed, this provides a possibly feasible way to disperse trailing vortices, since all of the injection required may be obtained by a redistribution of thrust.

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Technical Comment

Erratum: "Flight Investigation of the Influence of Turbulence on Lateral-Directional Flying Qualities"

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