

Abstract Submitted
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Aero-optical analysis of a separated shear layer using large-eddy simulation¹ KAN WANG, MENG WANG, University of Notre Dame — The aero-optical effects of a separated shear layer over a cylindrical turret are investigated based on the fluctuating density field obtained from large-eddy simulations. Good agreement of the velocity statistics and OPD_{rms} with experimental data validates the simulation results. The optical aberrations are compared with those caused by the turbulent boundary layer prior to separation in terms of their magnitude and structure, underlying physical mechanisms and Reynolds number dependence. It is found that the distortions by the separated shear layer are five times larger and spatially less homogeneous than those by the attached boundary layer. Pressure fluctuations are confirmed to be the main cause of aero-optical distortions, in contrast to the dominant role of entropy fluctuations in the turbulent boundary layer. With turbulent separation, the optical distortions induced by the shear layer show only weak Reynolds number dependence, which again differs from the case of a turbulent boundary layer.

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Meng Wang
University of Notre Dame

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