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Reduced Order Modeling for Beam Propagation through a Shear Layer JURGEN SEIDEL, STEFAN SIEGEL, CASEY FAGLEY, THOMAS MCLAUGHLIN, US Air Force Academy — The performance of airborne platforms emitting or receiving light beams is severely hampered by the flow field around the turret mounted on the air vehicle. From a fluid dynamics point of view, the flow separating from the turret develops large, coherent structures. These structures are associated with density variations, which, from an optical point of view, result in large optical distortions. The goal of this research is to improve system performance by mitigating these structures using feedback flow control. While developing a feedback flow control system is a multi-step process, one important step is the design of a Reduced Order Model of the flow field under consideration. For the canonical flow field of a shear layer behind a backward facing step, both simulations results and experiments data are compared and used to provide input training data for the development of a neural network model based on Proper Orthogonal Decomposition of the flow field. The design of the neural network, based on the time coefficients obtained from Proper Orthogonal Decomposition, is shown and analyzed. The model of the flow field is then utilized to develop feedback control strategies to mitigate the optically detrimental coherent structures.

Jurgen Seidel
US Air Force Academy

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