PHYSICS-BASED AND DATA-DRIVEN LOW-ORDER MODELING FOR TURBULENT FLOWS

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ABSTRACT

Advances in our capability to find patterns and their dynamics in turbulent fluid flows will improve our ability to predict, sense, control, and understand a range of systems relevant to science and engineering. However, modeling these systems is challenging due to the high-dimensional, chaotic, and multi-scale nature of turbulence. Fortunately, the construction of low-order representations of turbulence is being increasingly enabled by the progress in physics-based and data-driven modeling methods. Physics-based techniques, such as resolvent analysis [1], provide valuable insight about the underlying physical mechanisms sustaining turbulence, while data-driven methods, such as the spectral proper orthogonal decomposition (SPOD) [2], identify statistically relevant flow features. Furthermore, recent hybrid approaches promise to enable physics learning from data [3,4]. This minisymposium will bring together recent research efforts on the development of low-order models of turbulence and their application to pressing challenges in aeronautics, urban infrastructure, biomedicine and energy conversion.

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