# Leveraging DMD-ROM for Low-Cost Input-Output Characterization of a 3D Supersonic Jet

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Input-output frameworks are popular due to their ability to reveal amplification behaviors of a system and to guide actuator design. Operator-based methods, like the resolvent analysis, are a popular choice as it identifies optimal amplifications between forcing and response modes. However, the resolvent analysis is often accompanied with high computational costs and the requirement of a high-fidelity solver, limiting such analyses to numerical studies. We present a data-driven input-output framework as an alternative to the resolvent analysis, in which a reduced-order model is constructed on snapshots of the baseline flow using dynamic mode decomposition (DMD-ROM). Flow dynamics are subsequently evolved through the reduced model by time-stepping user-defined forcing sequences, and receptive control parameters are quickly identified in a low-cost manner. We demonstrate the method on a supersonic dual-stream jet flow, where the nozzle of interest houses Mach 1.6 core and Mach 1.0 bypass streams. The two streams mix downstream of the splitter plate trailing edge (SPTE), which produces instabilities and high frequency tones. We compare the findings of DMD-ROM with the classical resolvent analysis for a 2D jet. The framework is then extended for a 3D jet, where a range of forcing frequencies, actuation angles, and spanwise wavenumbers are considered along the SPTE surface.

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