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POD Analysis of Jet-Plume/Afterbody-Wake Interaction
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The understanding of the flow physics in the base region of a powered rocket is one of the keys to designing the next generation of reusable launchers. The base flow features affect the aerodynamics and the heat loading at the base of the vehicle. Recent efforts at the National Center for Physical Acoustics at the University of Mississippi have refurbished two models for studying jet-plume/afterbody-wake interactions in the NCPA's 1-foot Tri-Sonic Wind Tunnel Facility. Both models have a 2.5 inch outer diameter with a nominally 0.5 inch diameter centered exhaust nozzle. One of the models is capable of being powered with gaseous H_2 and O_2 to study the base flow in a fully combusting senario. The second model uses hi-pressure air to drive the exhaust providing an unheated representative flow field. This unheated model was used to acquire PIV data of the base flow. Subsequently, a POD analysis was performed to provide a first look at the large-scale structures present for the interaction between an axisymmetric jet and an axisymmetric afterbody wake. PIV and Schlieren data are presented for a single jet-exhaust to free-stream flow velocity along with the POD analysis of the base flow field.

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