

Abstract Submitted
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Large-Eddy Simulation of Crashback in a Ducted Propulsor

HYUNCHUL JANG, KRISHNAN MAHESH, University of Minnesota — Crashback is an operating condition to quickly stop a propelled vehicle, where the propeller is rotated in the reverse direction to yield negative thrust. The crashback condition is dominated by the interaction of free stream flow with strong reverse flow. Crashback causes highly unsteady loads and flow separation on blade surface. This study uses Large-Eddy Simulation to predict the highly unsteady flow field in crashback for a ducted propulsor. Thrust mostly arises from the blade surface, but most of side-force is generated from the duct surface. Both mean and RMS of pressure are much higher on inner surface of duct, especially near blade tips. This implies that side-force on the ducted propulsor is caused by the blade-duct interaction. Strong tip leakage flow is observed behind the suction side at the tip gap. The physical source of the tip leakage flow is seen to be the large pressure difference between pressure and suction sides. The conditional average during high amplitude event shows that the tip leakage flow and pressure difference are significantly higher. This work is supported by the United States Office of Naval Research under ONR Grant N00014-05-1-0003.

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