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Control of Base Pressure at Supersonic Mach Number in a Suddenly Expanded Flow
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Abstract
In improving the efficiency of applications for flow over a blunt body like missiles and rockets, passive and active control is used to increase the base pressure, hence reducing the base drag. It must be mentioned that this paper covers mainly a variety of passive control methods in the form of the cavity, rib, splitter plate, spike, and some others to regulate the base pressure and drag force. Later, this paper focuses on the control of base pressure in the form of the cavity at a Mach number of 2.2 and an area ratio of 4.84. In this experiment, Computational Fluid Dynamics (CFD) is used to model a convergent-divergent nozzle and a duct. The cavity's dimensions and locations are studied to get the optimum cavity's control of base pressure. Two sizes of the cavity are considered which are 3:3 and 6:3. The L/D is varied from 1, 2, 4, and 6 while the Nozzle Pressure Ratio (NPR) ranges from 3 to 16. The 2-D design of a convergent-divergent axisymmetric nozzle suddenly expanded into a duct with a diameter of 22 mm with and without annular rectangular cavities is sketched using ANSYS. The results show that the base pressure is greatly influenced by the cavity's dimension and location as well as the NPR.

Author Keywords
Base pressure control; cavity; supersonic

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