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Analysis of area ratio in a CD nozzle with suddenly expanded duct using CFD method
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Abstract
Whereas the demand for missiles and rockets has exponentially augmented, but the difficulties related to the gas dynamics of these vehicles remains to be a threat. Whenever there is a sudden expansion, the pressure in the downstream is sub-atmospheric. This low pressure in the recirculation zone leads to a considerable amount of drag, which is nearly two-thirds of the net drag of the aerospace vehicles. Hence, in view of the above problem, many researchers tried to control the base pressure depending upon the mission requirements. For example, in case of combustion chamber, we would like to decrease the base pressure as low as possible to have better mixing and efficient combustion, whereas, in case of the external ballistics application we would like to increase the base pressure as high as possible to reduce the drag of the projectiles to enhance the range. In this paper, investigated the effects of an area ratio in suddenly expanded duct and base pressure control with microjets using the computational fluid dynamics (CFD) method. A 1 mm orifice diameter of microjets placed at the pitch circle diameter (PCD) of 13 mm, located at 900 for active control. The Mach number is M = 2.2, the L/D ratio is 8, the nozzle pressure ratio's (NPR) is 9 and the area ratios are 2.56, 3.24, 4.86 and 6.25 considered in the present study. The design and modelling of convergent-divergent (CD) nozzle simulated using K-ε turbulence model for standard wall function. From the present results, it has been observed that the area ratio plays a crucial role in fixing the base pressure values.

Author Keywords
And Mach number; Area Ratio; CD Nozzle; CFD; L/D; NPR

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