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Pathan, K.A.^a, Dabeer, P.S.^b, Khan, S.A.^c

Influence of expansion level on base pressure and reattachment length

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^a Trinity College of Engineering and Research, Pune, Maharashtra 411048, India

^b Department of Mechanical Engineering, Acharya Institute of Technology, Bangalore, Karnataka 560107, India

^c Mechanical Engineering Dept, Faculty of Engineering, International Islamic University Malaysia, Kuala Lumpur, Selangor 50728, Malaysia

Abstract

In high speed projectiles like rocket, the thrust is created by the convergent divergent nozzle. The flow from the nozzle is exhausted in the enlarged duct of larger diameter to maximize the thrust. When the flow from the nozzle is exhausted in the enlarged duct, the base pressure gets reduced and hence increases base drag. This paper numerically simulates and investigates the flow field and the effectiveness of the Nozzle Pressure Ratio (NPR) on the base pressure, development of the flow field in the enlarged duct, the location of reattachment point, and the reattachment length. The supersonic flow was generated by the C-D nozzle, and the same is exited in the enlarged duct of area ratio 4.84 (ratio of enlarged duct area to nozzle exit area). The base pressure and the wall pressure distribution along the enlarged duct length have been studied. The Mach numbers considered for CFD analysis are 1.5, 2.0 and 2.5. NPR and the L/D ratios of the study are from 2, 5, and 8. Based on the results it is concluded that with enhancement in NPR, the nozzle becomes under-expanded, the reattachment length is reduced and the base pressure tends to get reduced at all the parameters of the present investigation. © 2019 PENERBIT AKADEMIA BARU. All rights reserved.

Author Keywords

Base pressure; Mach number; Nozzle pressure ratio; Supersonic flow

Correspondence Address

Pathan K.A.; Trinity College of Engineering and Research India; email: khizar.pathan@kjsedu.com

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