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**Minimum Length Rocket Nozzle Design using Method of Characterics (SCSH25)**

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Date: 9th February 2025

# Abstract

In this study, a methodology based on the Theory of Characteristics is presented for the design of two-dimensional rocket nozzle with minimum-length nozzle configuration. Such a configuration is determined to achieve an optimal Mach number at the exit while ensuring uniform flow in the diverging section. The study has been inspired by Hassan’s literature [1] which emphasis on this approach. This approach is then adapted by Fernandes’s work [2] who then utilizes a optimization process as a surrogate based optimization to improve shape and reducing computational power. A numerical approach in Scilab using mathematical, semi-empirical models is developed to solve the governing equations for steady, inviscid, irrotational, and supersonic flow in two dimensions. The analysis assumes that the flow remains consistent in the converging section, allowing for an arbitrary converging profile. Consequently, the primary design focus is placed on the diverging section to optimize performance. The proposed method provides an efficient and precise approach to supersonic nozzle design, ensuring both aerodynamic efficiency and flow uniformity at the exit.

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| Minimum length nozzle design schematic, adapted from [2] |

# References

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3. Khan, Md Akhtar, Sanjay Kumar Sardiwal, MV Sai Sharath, and D. Harika Chowdary. "Design of a supersonic nozzle using method of characteristics." *International Journal of Engineering and Technology* 2 (2013): 19-24. <https://doi.org/10.17577/IJERTV2IS110026>