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DOI

10.1016/j.matpr.2021.02.361

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Materials Today: Proceedings • Volume 46, Pages 2673 - 2676 • 2021 • 2nd International Conference on Smart and Sustainable Developments in Materials, Manufacturing and Energy Engineering, SME 2020 • Nitte • 22 December 2020 through 23 December 2020 • Code 170455

Estimation of Mach numbers in supersonic jets using schlieren images

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Abstract

Supersonic nozzles are commonly used in mechanical and aerospace engineering applications for decades. Therefore, it is essential to study their characteristics and discover techniques to measure relevant flow properties with minimal investment in terms of time, money, and efforts. Supersonic jets are composed of shock waves and expansion waves, making the flowfield complex and difficult to probe and investigate. Some important parameters that are needed to understand the supersonic jet include the shock-cell orientation and the variation of the Mach number along the jet centerline. Expensive equipment and highly skilled manpower are needed to get this information both in the lab environment and in real applications. A simple yet effective approach is presented in the present work to get reasonable estimates of the Mach number from the schlieren images for a Mach 2.0 nozzle jet. Results are compared with the numerical simulations for the estimated Mach number from the experimental data. © 2021 Elsevier Ltd. All rights reserved.

Author keywords

Image processing; Numerical simulations; Pixel intensity; Schlieren; Supersonic Jet

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