

Comparison of the performance of symmetric and asymmetric strut based fuel injection systems for scramjet combustor

A THESIS

Submitted by

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for the award of the degree

of

Master of Science (M.S)



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(Revised Copy)

I dedicate my thesis to my loving late father

THESIS CERTIFICATE

This is to certify that the thesis titled “**Comparison of the performance of symmetric and asymmetric strut based fuel injection systems for scramjet combustor**” submitted by **Tushar Kant Swain** to the Indian Institute of Technology Mandi, for the award of the degree of Master in Science (M.S) is the bonafide record of the research work done under my supervision. The content of this thesis in full or in part is not submitted to any other institute for the award of any degree.

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Declaration by the Research Scholar

I hereby declare that the entire work embodied in this thesis is the result of the investigations carried out by me in the School of Engineering, Indian institute of Technology Mandi, under the supervision of P. Anil Kishan, and that is not submitted anywhere for the award of the degree. In keeping the general practice, due acknowledgements have been made wherever the work described is based on the finding of other work.

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Signature

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Abstract

A new asymmetric strut based fuel injection system is proposed for the enhancement of the fuel – air mixing and combustion in supersonic combustors. The strut configuration is redesigned from a wedge shaped symmetric strut to asymmetric strut in such a way that asymmetry in the strut creates the additional recirculation along the Z (longitudinal) axis after the flow crosses over the lip of the strut. In the downstream stream of the combustor, the flow circulation grows resulting in improved mixing of fuel – air. The fuel is injected from the strut about the centerline of the combustor. Due to the presence of vortices inside the combustor the air and fuel mixes properly which increases the mixing and combustion efficiencies. Various performance parameters for the asymmetric strut are compared with a symmetric wedge shaped strut case to present a quantitative comparison between two different struts. It is found from the current simulations that the asymmetric strut has better combustion efficiency and mixing efficiency. The amount of H₂O formed is more for the asymmetric strut which is an indication of better mixing and combustion.

Keywords: Ramjet, scramjet, struts, air, nozzle, pressure, supersonic, turbulence, Mach number.

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