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Stepped aerospike for enhanced drag reduction using multiple intermediate shocks.[1] ANKIT KUMAR, SWAPNIL MAJUMDER, SANDEEP SAHA, Indian Institute of Technology, Kharagpur — Drag reduction in supersonic vehicles has been achieved using several techniques among which passive aerospikes are the most reliable solution. Various aerospike designs have been extensively studied where the fore-geometry is modified to enhance the drag reduction. In the present work aft-geometry modification in the form of a stepped spike is explored. Planar inviscid, axisymmetric viscous flow simulations and wind-tunnel tests are conducted at a Mach number of 2.43 to analyse the drag reduction of the two spikes of aspect ratio 1.5. The inviscid flow features like shocks and expansion fans are studied using the inviscid simulation, whereas the viscous flow simulations incorporate the effects of the separated shear layer. Viscous flow results are validated with schlieren images from wind tunnel experiments. The steps introduce multiple shocks which eventually reduce the strength of the re-attachment shock. The effect of the re-circulation zones and the interaction of shocks and expansion fans are studied using different step locations. Wave drag reduction over a conventional aerospike ranges from 9.32% to 21.06% as step locations are varied.

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