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Evaluation of entropy production in a vacuum objective supersonic ejector via unsteady Reynolds-averaged Navier-Stokes simulation[1]
DEEPANSHI SISODIYA, JESSE MORALES , SINA KHEIRKHAH, JOSHUA BRINKERHOFF, University of British Columbia Okanagan — Unsteady Reynolds-averaged Navier-Stokes simulations are performed to investigate entropy production in a supersonic air ejector operating with three area ratios and at two stagnation pressure ratios. Local entropy generation is dominated by viscous dissipation in the flow at locations corresponding to the flow unsteadiness, shear layer instabilities, recirculation zones and shock structures. Particularly, the flow structure inside the primary nozzle is found to have a significant impact on the ejector irreversibility. As the area ratio is increased, the nozzle flow transmutes from under-expanded to over-expanded. The over-expanded nozzle generates significantly higher entropy via a shock-induced flow separation inside the primary nozzle with the major production at the shock front when compared with the under-expanded nozzle wherein the major entropy production is near the flow separation zones. A higher-pressure ratio if dominated by the unsteady flow separation zones in the diffuser generate more irreversibilities when compared with the lower stagnation pressure ratio wherein the unsteady flow features are absent during the steady operation. These findings provide insight into identifying the main sources of loss and perhaps their minimization.

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