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Engine performance analysis for mode transition conditions in Rotating Detonation Engines using detailed numerical simulations[1]
PRASHANT TAREY, PRAVEEN RAMAPRABHU, University of North Carolina, Charlotte, JACOB MCFARLAND, Texas AM University — Mode Transition (MT) is a phenomenon of abrupt change in the number of detonation waves, occurring in a Rotating Detonation Engine (RDE), and is due to a change in inlet conditions, such as plenum pressure, fuel reactivity or mass flow rate. MT can result in sudden changes in engine performance[1] or detonation failure. In this work, we report results from numerical simulations on the effect of MT on three, key engine performance parameters – thrust, specific impulse and mass flow rate. The working fuel was stoichiometric H_2-O_2 mixture, while the N_2 dilution was varied to trigger MT. Sensitivity of the new mode configuration on the N_2 perturbation trajectory was also examined. It was observed that the engine thrust showed little variation with the change in N_2 dilution. All the simulations were performed on a 2D unrolled RDE geometry with discrete nozzle injectors. The compressible Euler equations were solved using the FLASH[2] code, with a Piecewise Parabolic Method on a cartesian mesh. [1]A. George et al., Proc. Comb. Inst., 36 (2), 2691, (2017). [2]B. Fryxell et al., Astrophys. J., Suppl. Ser. 131, 273 (2000).

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