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COMPARISON OF ROCKET ENGINE COOLING CHANNEL GEOMETRIES ENABLED BY ADDITIVE MANUFACTURING

Abstract

Modern liquid rocket engines require cooling strategies in order to withstand high combustion temperatures. Future propulsion technologies like nuclear thermal rockets will have to manage even higher heat fluxes due to the use of low molecular weight propellants like hydrogen. The most common method used to address this problem is regenerative cooling, in which cryogenically cooled propellant is passed over the hot surfaces of the engine to cool them before being used later in the engine cycle to power turbomachinery. The geometry of the cooling passages that direct the propellant are important in determining the cooling efficiency. Novel channel geometries are now being enabled by additive manufacturing techniques like powder bed fusion and directed energy deposition. In this paper, several channel geometries enabled by additive manufacturing are designed. The flow characteristics like pressure drop and temperature are modeled for each geometry through the use of computational fluid dynamics. A comparison between the performance of each design is presented.