Paper ID: 10749
student

SPACE PROPULSION SYMPOSIUM (C4)
Joint Session on Nuclear Propulsion and Power (7.-C3.5)

Author: Mr. Douglass Casey
Propulsion Research Center, University of Alabama in Huntsville, United States, dwc0004@uah.edu

CFD ANALYSIS OF HYDROGEN DISSOCIATION STRATEGY FOR NTR

Abstract

Molecular hydrogen is usually the baseline propellant suggested for a nuclear thermal rocket (NTR). Its low molecular mass makes it an ideal propellant choice. If atomic hydrogen were used instead, a rocket's specific impulse would nearly double. If atomic hydrogen could be applied in solid-core NTR technology in the near-term, performance gains could be achieved which are usually associated with other, less near-term propulsion technologies (such as gas-core reactors). This paper will explore a strategy for producing atomic hydrogen through dissociation in an NTR reactor. The proposed strategy uses impinging jets in the flow channels of the reactor fuel elements to raise the propellant temperatures. This strategy allows atomic hydrogen to be available for nozzle flow while using the less reactive molecular hydrogen for propellant delivery and as a buffer gas for the fuel channel walls. Computational fluid dynamics (CFD) will be used to analyze the propellant flow and model the hydrogen dissociation for various configurations of this strategy.