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A FIELD REVERSED CONFIGURATION FUSION SYSTEM APPLIED TO SPACE PROPULSION

Abstract

At the Instituto Tecnológico de Aeronáutica (ITA), in Brazil, the research segment on computational analysis of fusion systems for space propulsion began, and for this purpose a mathematical model of a fusion rocket engine with a compact geometry that uses a Field Reversed Configuration (FRC) magnetic confinement was developed, which allows a high plasma beta. The FRC employs a set of linear solenoidal magnetic coils for confinement, operates at higher fusion power density for a given magnetic field strength than other magnetic confinement plasma devices and consists of two distinct regions: a closed-field-line torus inside the separatrix and an open-field-line region outside the separatrix. The fuels explored are Helium-3 and Deuterium, as they present an aneutronic primary reaction, and a magnetic nozzle exhaust the charged reaction products. This paper presents the model developed, as well as the results of the estimated performance calculations of such a system, which, due to its high exhaust velocity, allows it to reach destinations in the solar system with a larger payload more quickly, and transmit more delta-v than traditional propulsion methods.