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ANALYSIS AND OPTIMIZATION OF NUCLEAR ROCKET OPTIONS FOR CREWED MARS EXPLORATION

Abstract

Nuclear thermal propulsion demonstrates irreplaceable advantages in crewed Mars exploration missions in aspect of faster orbital transfer and lighter mass. To fully grasp the principles and to further maximize the advantages of nuclear thermal propulsion in crewed Mars exploration, main cycle modes and working modes of nuclear thermal propulsion are deliberated. Performances of expander cycle and bleed cycle for nuclear thermal rocket engine are discussed by approach of establishing the static characteristic model of nuclear thermal rocket engine and calculating the key parameters such as thrust, specific impulse and node physical properties of each component module. Based on cycle models established, characteristics of bimodal nuclear thermal rocket (BNTR) and LOX-augumented nuclear thermal rocket (LANTR) are evaluated and compared. Meanwhile, effects of applying Mars in-situ resources as working medium on holistic engine performance are analyzed. As a consequence of previous study, crewed Mars exploration schemes targeted at shortened transit time and less payload are optimized adaptively to each model.