

High Thrust Upper Stage Solar Hydrogen Rocket Design

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Abstract : The conversion of solar thruster model to an upper stage hydrogen rocket is considered. Solar thruster categorization limits its capabilities to low and moderate thrust system with high specific impulse. The current study proposes a different concept for such systems by increasing the thrust which enables using as an upper stage rocket and for future launching purposes. A computational model for the thruster is discussed for solar thruster subsystems. The first module depends on ray tracing technique to determine the intercepted solar power by the hydrogen combustion chamber. The cavity receiver is modeled using finite volume technique. The final module imports the heated hydrogen properties to the nozzle using quasi one dimensional simulation. The probability of shock waves formulation inside the nozzle is almost diminished as the outlet pressure in space environment tends to zero. The computational model relates the high thrust hydrogen rocket conversion to the design parameters and operating conditions of the thruster. Three different designs for solar thruster systems are discussed. The first design is a low thrust high specific impulse design that produces about 10 Newton of thrust. The second one output thrust is about 250 Newton and the third design produces about 1000 Newton.

Keywords : space propulsion, hydrogen rocket, thrust, specific impulse

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