WPI Aerospace Engineering Dept

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MS Candidate

MS Thesis Defense Presentation

Plasma Density and Electron Temperature Measurement in a Radio Frequency (RF) Cathode using a Double Langmuir Probe

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Abstract: A Modular Test Unit – Radio Frequency (RF) Cathode (MTU-RFC) was designed and constructed to allow for reconfiguration, integration of a diagnostic probe, and use with different propellants. Using a radio frequency (RF) plasma source as an alternative to thermionic hollow cathodes allows for alternative propellants to be used in electric propulsion systems while mitigating common failure modes and performance degradation present in thermionic emitters. A compensated and uncompensated double Langmuir probe (DLP) has been designed to measure the plasma density and electron temperature in the RF cathode. A thorough investigation into radio frequency compensation has been conducted to determine a design that can accurately measure the plasma parameters of interest. The uncompensated double Langmuir probe has been tested and validated using a glow discharge as a baseline. Despite the prevailing theory that the intrinsic compensation of a floating DLP is sufficient in a RF environment, the need for additional compensation is demonstrated through the use of the uncompensated DLP in the RF plasma. Measurements conducted with the compensated DLP compared to the MTU-RFC global model indicate good agreement of the temperature and density. Based on preliminary experimental results, the design of the compensated double Langmuir probe will be utilized in further testing to ensure measurement accuracy.

Dissertation Committee:

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