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ALTERNATIVE APPROACH ON CALIBRATION OF MICRONEWTON THRUST STAND USING COMMERCIAL HEAT SINK

Abstract

Micronewton thrust measurement facility is being set up to support our future micropropulsion research activities. This paper presents an alternative approach to calibrate torsional micronewton thrust stand using commercially available heat sink. When a potential difference is applied across a pair of heat sink that are engaged at a particular distance, an attractive electrostatic force is generated. A few commercial heat sinks of different geometries are selected for existing study. The electrostatic force produced by the heat sinks is measured using precision weighing balance of 1mg resolution. Depending on the voltage applied and geometry of heat sink, the heat sink calibrators are capable of producing forces in the range of 29μN to 3.3mN. The force produced is found to be very consistent, 4% of repeatability error at worst, over a range of engagement distance. The characterized heat sink calibrator is then installed on an in-house built thrust stand. By applying a known electrostatic force and measuring the thrust stand response, the sensitivity of the thrust stand is quantified to be 5.5μN/μm. Based on the specification of sensor, the resolution of thrust stand is estimated to be 0.825μN. These results suggest that heat sink calibrator is a cost effective and easy to implement approach to produce highly accurate and repeatable forces for calibration of micronewton thrust stand.