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DEMONSTRATION OF THE FULLY WIRELESS THRUST MEASUREMENT SYSTEM FOR  
MICROPROPULSION

**Abstract**

The fully wireless thrust measurement system for micropropulsion is developed and its necessity is discussed in this study. In recent years, as the number of small satellite launches has increased, its missions have become more diverse and complicated such as observing the atmosphere and remote sensing. In order to achieve these missions, a sophisticated orbit and attitude control using propulsion systems is needed. Hence, it is necessary to measure the thrust of propulsion systems accurately by a thrust measurement system before launching. While measuring thrust, the power used by a propulsion system is generally supplied from outside the vacuum chamber through harness connections. However, the tension and friction force due to harnesses interfere with the thrust measurement. Since the thrust of electric propulsion among micropropulsions is in the  $\mu\text{N}$ - $\text{mN}$  class, disturbances have a significant effect on thrust measurement. To eliminate disturbances, a propulsion system can be powered by on-board batteries. However, there are some problems in terms of discharge time, volume and weight of batteries. In fact, it takes at least several hours for preparations and experiments when thrust measurements are conducted. In long-time experiments, the thruster operation stops due to a shortage of battery power. Although a shortage problem can be solved by introducing more batteries, the thrust measurement system has still a weight limit. Thus, it remains difficult to measure the thrust when thrusters require a lot of power. Based on the above background, a WPT (Wireless Power Transfer) system is implemented in the micropropulsion in this study in order to simultaneously eliminate both the disturbance caused by the harness connection and the restrictions of using on-board batteries. Additionally, the merit is that WPT can be applied to any thruster, it does not need to change the harness of the power supply for each thruster. In this experiment, as the first step of WPT, thrust measurement is conducted on a 5W-class CGJ (Cold Gas Jet) with relatively low power among micropropulsions. The completely wireless CGJ is operated by the transmitted power. Then its thrust is measured. In addition, the necessity of the WPT on the thrust measurement is discussed.