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Author: Mr. Daixian Zhang
College of Aerospace Science and Engineering, National University of Defense Technology, China, zhangdaixian@163.com

Dr. Rui Zhang
College of Aerospace and Materials Engineering, National University of Defense Technology, China, nudtzhang@163.com
Dr. Jianjun Wu
National University of Defense Technology, China, jjwu@nudt.edu.cn
Dr. Zhen He
College of Aerospace and Materials Engineering, National University of Defense Technology, China, hezhen_2012@sina.com
Mr. Fan Zhang
China, fallinfall1024@gmail.com

PULSED MICRO-THRUST MEASUREMENT USING TORSIONAL PENDULUM TECHNIQUES

Abstract

Based on the Position Sensitive Detector(PSD) technique, two types of torsional pendulums which ranged from 100-1000 nNs(style A) and 1-1000μNs(style B) respectively, were developed and improved to measure the impulse bit or pulsed micro-thrust and to study fundamental physical processes of micro-thrusters. As the main part of system, the torsional pendulum stand consisting of bracket and beryllium bronze wire (for style A) or type "C" pipe(for style B), was placed in the vacuum tank. And a ligtht source of HeNe laser placed outside the vacuum tank, penetrating the window and irradiating on a mirror, was used. And the beam was reflected on the surface of mirror lay on the stand and irradiated into the PSD. The light signal was transformed into electrical signal in the PSD and acquired in real time by signal acquisition and processing subsystem(National Instruments). An electromagnetic damping system was designed, which made the thrust stand angular displacement signal oscillate around its equilibrium position and attenuate swiftly. In addition, an electromagnetic calibration technique was developed and improved. A pulsed micro-thrust was produced by coils powered by regular pulsed current. Uncertainty of the measured impulse bit was analyzed and was found to be less than 10 nNs(for style A) and 10μNs (for style B) with 95% credibility.