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Author: Dr. Cristóbal Nieto Peroy
Luleå University of Technology, Sweden

Dr. Jihyoung Cha
Luleå University of Technology, Sweden

IMPROVING THE EXPERIMENTAL SETUP OF THE KNATTE PLATFORM FOR ATTITUDE AND ORBIT CONTROL EXPERIMENTS

Abstract

The Kinaesthetic Node and Autonomous Table-Top Emulator (KNATTE) is a frictionless vehicle developed at Luleå University of Technology (LTU) in collaboration with La Sapienza University of Rome. A frictionless vehicle is a useful tool for implementing hardware-in-the-loop simulation methods and experimenting with spacecraft dynamics. Frictionless vehicles are particularly relevant for attitude and orbit determination and control experiments of small satellites because they can provide an ideal environment for testing and validating attitude control algorithms and systems. Additionally, the platform can be used to experiment with a variety of different scenarios.

The frictionless platform that is present in our laboratory has several problems that impairs it and prevents it from performing smooth experiments. There are small but significant deformities on the surface of the table, some connection failures between the main computer and frictionless vehicle, and unpredictable blackout events in the computer vision system (CVS), which yields position and attitude data.

In order to correct such problems, different modifications to the experimental setup have been performed with different results. The electrical and pneumatic systems of the frictionless vehicle have been adjusted to prolong the duration of the experiments and balance the effect of translational and rotational thrusters to appropriate thrust bits that the system can control. Additionally, the frictionless table has been analyzed and calibrated to remove spurious external forces that appear on different areas of the surface. This helps the platform move smoothly and consistently during the experiments. Finally, the CVS has been tested an alternative method of real-time denoising implemented to get continuous tracking service.

The results of these actions are improved accuracy and reliability of frictionless platform experiments. With a well-designed platform and appropriate components, the platform is able to move smoothly and consistently throughout the experiment, resulting in more accurate and reliable experiment results.