Paper ID: 58298
student

IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Virtual Presentations - IAF HUMAN SPACEFLIGHT SYMPOSIUM (VP)

Author: Ms. Adrianna Graja
Poland

Mr. Aleksander Gorgolewski
Wrocław University of Technology, Poland
Mr. Aleksander Bojda
Wroclaw University of Science and Technology, Poland
Mr. Kamil Beś
Wroclaw University of Science and Technology, Poland
Mr. Krystian Mirek
Wroclaw University of Science and Technology, Poland
Mr. Aleksander Sil
Wrocław University of Technology, Poland

TRACZ - TESTING ROBOTIC APPLICATIONS FOR CATCHING IN ZERO-G EXPERIMENT AS A PAYLOAD ONBOARD THE 26TH REXUS SUBORBITAL ROCKET

Abstract

Grasping different objects by robots in space conditions is in many cases neither effective nor convenient. Lack of a general-purpose device that can grab differently shaped and sized elements made from various materials is one of the many issues that have been spotted during space missions. A classical approach towards gripping objects by human-like rigid effector requires sophisticated trajectory planning algorithms, numerous sensors, and complicated mechanical design. The essential thing for the another approach is to use soft, elastic materials manipulated by pressure to adjust to an irregular-shaped object and catch it. Soft grippers are less complicated in construction and use, furthermore, they seem to be more all-embracing. "TRACZ" - Testing Robotic Applications for Catching in Zero-g is a fully autonomous mechatronic experiment, launched on March 19, 2019, onboard the REXUS rocket, during the 26th Campaign of the REXUS/BEXUS Programme. The structure was projected as an 1DOF manipulator, which effector was made as an elastic membrane fulfilled by ground coffee particles. The gripper mimicking a loose sack was obtained, which, due to the jamming phenomenon of the mesoscopic granulate inside, stiffens and a grip by a shape connection is possible. The project aimed to investigate the possibility of application of this kind of an elastic gripper in space, where one of the main jamming requirements - negative differential pressure, is impossible to obtain. Additionally, lack of gravitation could cause that the granular substance inside the gripper to behave unpredictably. During the REXUS rocket flight, in microgravity and vacuum conditions, series of catches have been performed on a single object and the force, with which the object was caught, has been measured. The results have been compared with an on-ground experiment and the utility of the aforementioned gripper in the space applications has been discussed.