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MODULAR MECHATRONIC COMPONENT DEVELOPMENT

Abstract

In this paper the development of space qualifiable modular mechatronic component is presented. The experience of past and ongoing space missions like ROKVISS, Kontur, Kontur-2 and MASCOT lead to a modular mechatronic component for space applications. Due to the need for light weight but still powerful positioning or traction devices in scientific driven space missions an integration of space suited parts to a compact actuator component is shown. A presentation of the developments, actual status and potential applications is given. Based on permanent synchronous BLDC motors robust and reliable actuator principle is used. Low backlash Harmonic Drive (HD) gears make up a precise and robust overall system. A close investigation on lubrication and friction conditions in thermal vacuum environment gives evidence on the level of operational capability. Also an overview of potential applications is given. From the beginnings as a robotic joint as it was in ROKVISS project to a small actuator in MASCOT for asteroid lander mission the developed technology is also appropriate for pan-tilt mechanism or scaled in size even locomotion of rover systems. Since MASCOT was launched already in December 2014 and will reach its target asteroid Ryugu in October 2018 special coating was used for cold welding prevention. During cruise phase different health checks were conducted to show friction behavior over that long time of four years. In cooperation with the part-time-scientists the field of traction units for rover application was targeted and also used in rover systems LRU (Light Weight Rover Unit) for the ROBEX (Robotic Exploration for extreme environments) analogue mission. Since ROBEX was a terrestrial mission on Mount Etna in 2017 to demonstrate the autonomy of cooperating robots the focus in that project was not the development of space proofed mechanics. Still the drive units used were built with the intention to build up a portfolio of actuator components for space missions. Drive units and pan-tilt units were tested for four weeks on Mount Etna and investigated after the mission. Comparison of terrestrial and space lubrication was conducted and different kind of sealing concepts was also tested. The gained knowledge is actually used in SPACEHAND project and also in an ongoing space robot development. With this broad range of applications and lots of experience in space missions on ISS but as well in deep space a modular mechatronic component that is scalable in size was developed and will be presented.