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ROBOTIC SYSTEM AND REFUELLING MECHANICAL INTERFACE DESIGN FOR THE ITALIAN IN-ORBITING SERVICING DEMO MISSION

Abstract

In the last years, significant effort has been invested into the development of In-Orbit servicing robotic systems, because it is believed that they will enable life extension, reliability improvement and performance upgrade of already existing satellite, which will help to reduce costs. Such systems can also perform de-orbiting of satellites which have reached their end of life, helping to improve the sustainability of space, or assembling large structures such as stations and in-orbit solar-powered facilities.
In this scenario, the Italian Space Agency (ASI) recently awarded a contract for In-Orbit Servicing demo mission to an Italian consortium led by Thales Alenia Space Italy, including Leonardo, Telespazio, Avio, D-Orbit, and other space companies.
This demo mission will include two spacecraft:

- A Servicer spacecraft, which will include the systems necessary to perform the mission
- A Target spacecraft, which will be fixed to the servicer during launch and will be released and recaptured by the robotic system

This paper will focus on the design of the Robotic system, which is under responsibility of Leonardo. The Robotic system shall perform the following tasks:

- Capture and rigidization of Target on Servicer by means of a gripper installed at a tip of a robotic arm, in order to dissipate potential residual velocities between the two spacecraft, and a dedicated berthing mechanism to establish a rigid connection between the satellites
- Refuelling of Target, by means of a refuelling interface, also developed by Leonardo, will allow the fluid transfer between servicer and target
- Assembly demonstration

The design of a control unit for a robotic arm presents major architectural issues since it involves several actuators and sensors with multiple electrical and EMC characteristics. In addition, the mechanisms are typically far away the electronics and this is a potential threat on the global performances of the system. Starting from the functions, the building blocks are derived from the related interfaces. The global performances are strictly related to the topology and a trade-off has to be completed among the different engineering disciplines. This work will present the essential elements of the electrical architecture applicable to the in-orbit servicing activities with identified initial requirements, design choices and relative

pros and cons.

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