

MATERIALS AND STRUCTURES SYMPOSIUM (C2)

Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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DEPLOYABLE SPACE MANIPULATOR COMMANDED BY MEANS OF VISUAL-BASED
GUIDANCE AND NAVIGATION**Abstract**

Deployment of large space structures in orbit requires special caution. In fact, the task of reaching the desired configuration, and at the same time safely preserving the structure integrity and not perturbing the overall spacecraft attitude, is not an easy task while dealing with extremely flexible structures as the space ones typically are. A continuous monitoring all along the manoeuvre is mandatory. In case manoeuvres are not executed just once during the mission, but are a repeated tasks, as in the case of space manipulators, this monitoring function increases its relevance and should become an element of the control loop. Visual-based techniques, i.e. techniques based on the analysis of the images captured by a set of cameras mounted on the deployable arms are a powerful option, even if space applications add some constraint with respect to well-assessed terrestrial use, concerning both the hardware (typical space requirements for limited mass, volume, power consumption, survivability to launch conditions and radiation environment) and the operations (extremely varied light conditions, with sudden dark/light passages). The paper analyses two possible options of assisted deployment of flexible links, namely the eye-in-hand, exploiting a camera mounted on the manipulator, and the hand-in-eye, with the camera fixed to the spacecraft main body and therefore not participating to the manipulator motion. The difference between the image processing tasks is remarkable, with the analysis and experimental tests to be carried out either in a fixed or in a moving frame. The effects of the flexibility of the manipulator's elements on this process are investigated, and the expected accuracy evaluated. This work is based on the experience gained with two-dimensional, gravity-free manipulators built and operated by the authors in the Guidance and Navigation Lab at the University of Rome La Sapienza.