MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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ADVANCED MULTIBODY SIMULATION TECHNIQUES FOR LARGE DEPLOYABLE SYSTEMS – THE IXO TELESCOPE CASE

Abstract

In recent years, space-system design has shown a clear trend towards increased configuration complexity in response to challenging mission requirements. Need for large apertures has been one major driver in this respect, including large solar arrays for increased power demand, large antenna reflectors, large sunshields for scientific missions (e.g. JWST telescope) and solar sails based concepts. Common to those applications are the use of several flexible components, the need for deployment and retrieval mechanisms, and above all the need to verify on ground the deployment functionality and the overall system performances. Representative deployment and performance testing on ground of such large structures are often very difficult if not impossible (mainly due to "gravity" effects, but also due to presence of air and other perturbing effects). As a consequence the need for increased use of highly sophisticated simulation tools and techniques has clearly emerged. This trend has also caused an evolution towards a multi-disciplinary design /verification approach, with major emphasis in the area of dynamics and control (particularly since increased accuracy end stability performances are more and more requested for pointing payloads and antennas). ESA has a long experience in using multi-body software, aiming at an integrated modelling and simulation of the structure / control interactions. In this paper the recent case of the International X-ray Observatory (IXO) is presented as a test case. Peculiar to the IXO telescope is the need to extend its focal length by a large amount (about 10 m) while ensuring extreme pointing accuracy and stability of the different telescope modules. The deployment principle is based on an innovative "articulated booms" concept, which is currently being investigated within (and outside) ESA. The elastic behaviour of the booms and the non-linear hinge characteristics (friction, backlash, hysteresis...) are modelled to simulate the system deployment dynamics. Application of advanced multibody software techniques will permit the investigation of coupled structural dynamics / control system, aiming at pointing accuracy / stability performance verification.