

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

Author: Prof. Paolo Gasbarri
Università di Roma "La Sapienza", Italy, paolo.gasbarri@uniroma1.it

Dr. Riccardo Monti
Sapienza University of Rome, Italy, riccardo.monti-somministrato@thalesalieniaspace.com

Dr. Marco Sabatini
Sapienza University of Rome, Italy, marcosabatini@hotmail.it

VERY LARGE SPACE STRUCTURES: NON-LINEAR CONTROL AND ROBUSTNESS TO
STRUCTURAL UNCERTAINTIES

Abstract

Continuous improvements in computational and computing sciences allow to develop more and more efficient control laws for space structures. These improvements are even more important when we are dealing with large space structures normally called VLSS (Very Large Space Structures). By virtues of this it is possible to study multi-disciplinary problems in a very deeply detailed way, cross-linking structural, control and attitude disciplines and by providing a very meaningful case of study. In this paper a full-coupled model of a VLSS, where all the contributions coming from the flexibility effects on inertial parameters (i.e., mass, static moments, moments of inertia, modal participation factors, etc. . .) jointly with gravity and gravity gradient forces will be considered. This model will be used to synthesize a non-linear attitude controller named SDRE, acronym of State Dependent Riccati Equation. This enhancement of the common used linear quadratic regulator allows to have better performances of satellite attitude dynamics. These improvement it is mandatory when stringent requirements on telecommunication/observation antennas pointing are imposed. In order to explore the characteristics of the synthesized controller a robustness analysis to structural uncertainties will be performed via Monte Carlo approach. Numerical simulations and critical review of the obtained results will be performed about the proposed case of study.