# CONTENTS


## INVITED PAPER

On the Maneuvering and Control of Space Structures 3
*L. Meirovitch, M.K. Kwak*

## SECTION 1: DYNAMIC MODELLING AND CONTROL TECHNIQUES

Stable Maneuver Control Laws for Distributed Parameter Systems 21
*J.L. Junkins, Z.H. Rahman, H. Bang*

Dynamics and Control of Flexible Interconnected Bodies: A Formulation with Application 45
*V.J. Modi, Y. Morita*

Optimal Large Angle Maneuvers of a Flexible Spacecraft 61
*P.M. Bainum, F. Li*

Integrated Structural/Control Design via Multiobjective Optimization 77
*G.L. Schneider, R.A. Calico, Jr*

Vibration Control in Large Systems with Unmodeled Dynamics 93
*C.J. Maday, N.H. Johnson*

Controller Order Reduction for Flexible Spacecraft Using Closed-Loop Balancing Methods 105
*K.A. Carroll, P.C. Hughes*

A Review of Model Reduction Methods for Structural Control Design 121
*R.R. Craig, Jr, T-J. Su*

Closed Loop Lab Tests of NASA's Mini-Mast 135
*C. Hsieh, J.H. Kim, R.E. Skelton*

A Dynamics Parameter Invariant Attitude Control System for Flexible Spacecraft 157
*S.J. Dodds, R.P.G. Heath*

A Hierarchical Approach to Large Space Structure Control 183
*K.D. Young*

## SECTION 2: MULTIBODY DYNAMICS, ROBOTICS AND DESIGN

Dynamics of Systems with Interconnected Flexible Members in the Presence of Thermal Deformations 199
*V.J. Modi, A.C. Ng*

Lumped Mass Computations from Consistent Elements with Applications in Flexible Multibody Dynamics - Linking FEM Codes and DADS 215
*O. Friberg, V. Karhu*

Superposition Method for Stress Stiffening in Flexible Multibody Dynamics 233
*O. Wallrapp, J. Santos, J. Ryu*

Lypunov Stable Penalty Methods for Imposing Holonomic Constraints in Multibody System Dynamics 249
*A.J. Kurdila, J.L. Junkins, S. Hsu*

On Structural Design of Active Structures 265
*W. Charon, U. Buck, A. Newerla*

Efficient Simulation of In-Orbit Transportation and Control of Flexible Beams by a Free-Flying Robotic Device 281
*J. Marczyk, A. Bellazzi*

The Use of Kane's Equation to Write a Continuous Model of a Flexible Robot as a Step Toward a Discrete Model 305
*J.C. Piedbœf , R. Hurteau*

Recent Developments in Learning Control and System Identification for Robots and Structures 321
*M. Phan, J-N. Juang, R.W. Longman*

General Design Tool for Flexible Space Mechanisms 335
*O.I. Sivertsen, K. Aamnes, T. Rølvåg*

Flexible Multibody Dynamics Based on a Fully Cartesian System of Support Coordinates 353
*N. Vukasovic, J.T. Celigüeta, J. García de Jalón, E. Bayo*

## SECTION 3: NUMERICAL ANALYSIS, FINITE ELEMENT METHODS, EXPERIMENTAL METHODS

Active Damping of a Truss Structure Using Piezoelectric Actuators 369
*A. Preumont, J-P. Dufour, M. Sparavier*

Experimental Verification of Structural Control 383
*L.D. Peterson*

Ground Based Dynamic Testing of Flexible Composite Satellite Structures 397
*D.A.C. Sparry, L. Hollaway*

Finite Element Modeling of Flexible Tracks 411
*A. Cardona, M. Géradin*

Non-Linear Vibration of Large, Imperfect Space Structures 425
*H. Öry, A. Rittweger, E. Hornung, E. Erben*

Dynamic Stability of Buckling Elastic Structures 449
*D. Dinkler, B. Kröplin*

Material Property Measurements for Viscoelastic Space Structures 461
*D.J. McTavish, P.C. Hughes*

Two-Dimensional Continuous Elements 475
*P.H. Kulla*

A Time Domain Identification Approach for Low Natural Frequencies and Light Damping Structures 491
*A. Agneni, L.B. Crema*

A Recursive Computational Method for the Dynamic Analysis of Beam-like Periodic Structures 505
*A. Agneni, S. Sgubini*

## SECTION 4: TETHERS AND TETHERED SATELLITES, ON-ORBIT SYSTEM IDENTIFICATION, SPACE STATION DYNAMICS

Attitude Dynamics of a Spinning Tethered System in Leo 521
*M.B. Quadrelli*

Offset Control of Tethered Systems: An Experimental Verification 547
*V.J. Modi, P.K. Lakshmanan, A.K. Misra*

Tethered Satellite System Dynamics and Control 563
*B. Musetti, B. Cibrario, L. Bussolino, C.S. Bodley, H.A. Flanders, D.K. Mowery, D.D. Tomlin*

Tethered Satellite System-Satellite Attitude Control 587
*B. Musetti, I.T. Mitchell*

Orbit Circularization Using a Tether of Varying Length 603
*M. Morana, M.B. Quadrelli*

Modelling and Identification of Flexible Spacecraft 617
*P.Ph. van den Broek, J.A. Mulder, Q.P. Chu*

Eigenvalue Realisation Methods for the In-Orbit Identification of Large Flexible Spacecraft Structures 629
*J.E. Cooper, J.R. Wright*

System Modes and Dynamics of the Proposed Space Station Type Configurations 645
*V.J. Modi, A. Suleman*

**Author Index** 661