

# **45th Israel Annual Conference on Aerospace Sciences 2005**

**Tel Aviv, Israel  
23-24 February 2005**

**Volume 1 of 2**

**ISBN: 978-1-62276-443-3**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2005) by the Faculty of Aerospace Engineering, Technion - Israel Institute of Technology  
All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact the Faculty of Aerospace Engineering, Technion - Israel Institute of Technology at the address below.

Faculty of Aerospace Engineering  
Technion - Israel Institute of Technology  
Kiryat Technion, Haifa 32000, Israel

[iacas@technion.ac.il](mailto:iacas@technion.ac.il)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## VOLUME 1

### INVITED PLENARY LECTURES

<b>Turbulence Modelling and Validation Activities at ONERA/DMAE</b> .....	1
<i>Bertrand Aupoix</i>	

### STUDENT COMPETITION

<b>Chameleon: The In-Flight Simulator UAV</b> .....	15
<i>L. Zivan, A. Sosna, I. Klein, P. Livshiz, B. Eskin, G. Eilam, A. Stekler, O. Avital, R. Markovich, S. Stafora, V. Dobrovolski, M. Shernosher, M. Kriger, B. Prutkin, S. Tsach</i>	
<b>Nanosatellite for Lunar Gravity Mapping by Intrasatellites Laser Measurements</b> .....	38
<i>E. Hayun, A. Rokach, A. Fertman, G. Hajaj, H. Werner, Y. Cohen, A. Skorohod, A. Novikov, V. Shimankov, N. Sheinberg, S. Goldin, David Mishne, Fred Ortenberg</i>	
<b>Wing-in-Ground-Effect Transport Aircraft “SAMSON”</b> .....	63
<i>Baruch Gaiduk, Evgeny Yujelevski, Olga Markovich, Arie Prosvetov, Daniel Kutikov, Alexander Klebanov, Inna Kaprovsky, Alexei Rosich, Roman Reitbort, Evgeny Shavelzon, Joseph Shamenzon, Dror Artzi</i>	

### ROCKET PROPULSION

<b>Mechanism of Combustion of Nitramine Based Double Base Propellants</b> .....	79
<i>Haridwar Singh</i>	
<b>Analysis of a Cycle Combining a Ducted-Rocket for a Space Launcher</b> .....	86
<i>Gidon Fridman, Alon Gany</i>	
<b>A Scientific Approach for Life Extension of Solid Rocket Propellants/Rocket Motors</b> .....	113
<i>Haridwar Singh</i>	

### CFD I

<b>Preliminary Validation of a Chimera Based Flow Solver for Store Separation Simulation</b> .....	122
<i>Motti Adar, Yuval Levy</i>	
<b>Numerical Simulation and Reduced-Order Modeling of Airfoil Gust Response</b> .....	139
<i>Avi Zaide, Daniella Raveh</i>	
<b>CFD and Experimental Study of Rocket Plume Effects on Missile Longitudinal Aerodynamic Stability</b> .....	156
<i>G. Avital, J. Pompan, J. Macales, S. Yaniv, S. Gali</i>	
<b>Development of a CFD Navier-Stokes Platform for Simulation of Supersonic/hypersonic Turbulent Reactive Flows – Application to Air/H<sub>2</sub> Combustion Processes in a Scramjet Engine for Airbreathing Hypersonic Propulsion</b> .....	N/A
<i>S. Seror, Y. Burtschell, J. Giordano, D. Zeitoun</i>	

### GNC I

<b>Wings Deployment UAV Control System Via Second Order Sliding Modes Method</b> .....	177
<i>Agnes Cohen, Isaac Yaesh, Arie Levant</i>	
<b>New Euler-Vector and Quaternion Filters</b> .....	192
<i>I.Y. Bar-Itzhack, Yizhar Cohen</i>	
<b>Estimation Lower Bounds for Fault-Prone Systems: Recent Developments</b> .....	224
<i>Iliia Rapoport, Yaakov Oshmany</i>	
<b>Mixed Actuation Concept for FBW Systems on Small Commercial Aircraft</b> .....	246
<i>Avner Sirota, Amnon Rosler, Moshe Attar, Keith Rosenberg</i>	

### STRUCTURES I

<b>Aeroservoelastic Modeling of a Wind Tunnel Model with Piezoelectric Strain Actuators</b> .....	255
<i>M. Karpel, B. Moulin, V. Feldgun</i>	

<b>Aeroelastic Simulations for Non-Linear Flow</b> .....	268
<i>Zvi Sheena, Luciano Fornasier</i>	
<b>Predicting Fatigue Life and Residual Strength of Composite Material Structures</b> .....	283
<i>Zvi Granot, Abraham Brot, Gila Ghilai, Shlomit Gali</i>	
<b>Increasing Fatigue Crack Detection Inspection Intervals by Means of Low-Frequency Eddy-Current Non-Destructive Inspections</b> .....	298
<i>C. Matias, A. Brot, W. Senderovits</i>	

## **AERODYNAMICS**

<b>Control of Flap Vortices</b> .....	313
<i>David Greenblatt</i>	
<b>The Concept of Hybrid Transonic-Subsonic Wings</b> .....	328
<i>M. Steinbuch, B. Marcus, M. Shepshelovich</i>	
<b>Adjustment of Aerodynamic Characteristics of an External Store Using Flight Test Data</b> .....	338
<i>Ron Odes, Kobi Enciu</i>	
<b>Aerodynamics of Contaminated UAV Wings</b> .....	351
<i>B. Marcus, M. Sarid, M. Shepshelovich</i>	

## **AIRCRAFT DESIGN & PERFORMANCE**

<b>Conceptual Definition of a 6-PAX “MICRO-JET” Configuration</b> .....	362
<i>Aaron Yaniv, Arie Pratzovnik, David Penn</i>	
<b>Aircraft Weighing Procedure Error Analysis - Flight Safety Implementations in the IAF</b> .....	384
<i>Moshe Shomer, Eli Koskas</i>	
<b>The Bingo Fuel Optimization Problem Revised – A Generalized Approach to Define a Robust Bingo Algorithm</b> .....	408
<i>Ariel Dvorjetski, Eyal Shabi, Gil Levin</i>	

## **COMBUSTION & SPRAYS**

<b>A Simple Model of a Gel Spray Diffusion Flame</b> .....	431
<i>A. Kunin, J.B. Greenberg, B. Natan</i>	
<b>Experimental Study of a Pulsatile Injection Gel Spray</b> .....	446
<i>Victor Chernov, Benveniste Natan</i>	
<b>Simultaneous Grouping and Evaporation of Spray Droplets in Oscillating Flow-Theoretical Analysis</b> .....	459
<i>David Katoshevski</i>	

## **CFD II**

<b>Multipoint Optimization of Aerodynamic Shapes</b> .....	468
<i>S. Peigin, B. Epstein</i>	
<b>Three Dimensional Harmonic Excitation of a Turbulent Mixing Layer</b> .....	481
<i>Yuli Lifshitz, David Degani</i>	
<b>Missile Stage Separation Incorporating Six Degrees of Freedom Motion</b> .....	495
<i>Yoram Rapoport, Ziv Lavee</i>	

## **GNC II**

<b>An Improved Integer Ambiguity Resolution Technique for Fixed Arrays</b> .....	500
<i>Jonathan D. Wolfe, Jason L. Speyer</i>	
<b>Fast Graph-Search Algorithms for General Aviation Flight Trajectory Generation</b> .....	518
<i>Eran Rippel, Aharon Bar-Gill, Nahum Shimkin</i>	
<b>Constrained Estimation for Ballistic Trajectory Tracking</b> .....	548
<i>Meir Pachter, Eric B. Nelson, Stanton Musick</i>	

## **STRUCTURES II**

<b>Using Probabilistic Simulations in Order to Minimize Fatigue Failures in Metallic Structures</b> .....	554
<i>Abraham Brot</i>	

<b>Buckling Behavior of Composite Laminated Stiffened Panels Under Torsion</b> .....	568
<i>H. Abramovich, T. Weller, C. Bisagni</i>	
<b>Notched Bodies Subjected to Thermal Loads</b> .....	579
<i>Chaim Ishbir, Leslie Banks-Sills</i>	

### **SPACE SYSTEMS**

<b>Stationkeeping about the Collinear Equilibrium Points in the Restricted Three-Body Problem</b> .....	587
<i>Dani Meltzer, Pini Gurfil</i>	
<b>Optimal Formationkeeping for Formation Flying Spacecraft</b> .....	603
<i>Pini Gurfil</i>	
<b>TECSAR PROGRAM – System Features, Configuration and Status</b> .....	N/A
<i>Y. Efraty</i>	

### **UAVS**

<b>Wing Concepts for Tactical UAV</b> .....	622
<i>A. Nagel, M. Steinbuch, M. Shepshelovich</i>	
<b>The CAPECON Program: Civil Applications and Economical Effectivity of Potential UAV Configurations</b> .....	634
<i>Akiva Peled, Shlomo Tsach, David Penn, David Hillel Touitou</i>	

## **VOLUME 2**

<b>Incremental Process for the Development of Mini UAV</b> .....	654
<i>Avi Abershitz</i>	

### **INVITED PLENARY LECTURES**

<b>Three Decades of Progress in Circulation Control High Lift Systems</b> .....	658
<i>John L. Loth</i>	

### **GNC III**

<b>Spacecraft Angular Rate Estimation from Vector Observations Using a Fast Particle Filter</b> .....	685
<i>Avishy Carmi, Yaakov Oshman</i>	
<b>Integrated Autopilot-Guidance for Dual Control Missiles Using the Sliding Mode Approach</b> .....	708
<i>Moshe Idan, Tal Shimay, Oded M. Golan</i>	
<b>Optimal Rocket Guidance with Lateral Pulse Jets</b> .....	731
<i>B. Gendler, I.Yaesh, J.Z. Ben-Asher</i>	

### **JET PROPULSION**

<b>Inverse Jet Engine Model for Performance Prediction in Transient Operation</b> .....	743
<i>Michael Lichtsinder, Yeshayahou Levy</i>	
<b>Low- and High-Frequency Pressure Oscillations Obtained from a Single-Stage Low-Speed Axial Compressor</b> .....	763
<i>Joseph Pismenny, Yeshayahou Levy</i>	
<b>F100PW-229I Thermodynamic Model Simulation with “GASTURB 9”</b> .....	789
<i>Aviad Brandstein, Yaron Nakash, Yuval Efrati, Dmitry Perel</i>	

### **STRUCTURES III**

<b>Re-Design of a Helicopter Component Transmission by Composite Material</b> .....	816
<i>S. Laurenzi, D. Di Nallo, F. Valente, M. Marchetti, E. Lalia Morra, E. Anamateros</i>	
<b>The Conservative M-Integral for a Delamination Along a 0/90 Interface: The Thermal-Elastic Problem</b> .....	829
<i>O. Dolev, L. Banks-Sills</i>	

<b>Buckling Load Enhancement of Flexible Columns Using Piezoelectric Patches</b> .....	836
<i>Yulia Freedman, Haim Abramovich</i>	
<b>Risk Analysis For IAF F-16 Wing Attach Fitting (WAF)</b> .....	855
<i>Rotem Halevi, Ido Kochavi, Haim Ishbir, Sason Bar Moshe</i>	

### **AEROSPACE SYSTEMS & TESTS**

<b>Aircraft Fire Safety Detection and Suppression</b> .....	868
<i>Ilan Berlowitz</i>	
<b>Deployable Mesh Antenna</b> .....	909
<i>U. Nissel, E. Kats, M. Shmulevitz, Y. Altshuler, E. Matza, A. Aharonov, N. Elhai, S. Sabatello</i>	
<b>Experimental Study by Spectrum Analysis of the Influence in Overweighed UH-601 Blackhawk for the Functionality of Dynamic and Airframe Components</b> .....	928
<i>Alexander Kushnirsky, Benny Azoulay, Efraim Rabinovich</i>	
<b>Evaluation of Refurbishment Procedure to Flight Safety Components: "Over All Repair Instructions", Fatigue Re-Substantiation Process</b> .....	940
<i>Marcelo Mileguir, Yaniv Bendet-Roser, Ido Kochavi, Am-ad Maimon, Cohen Haim, Sason Bar-Moshe, Tzahi Ankori</i>	

### **ELECTRO-OPTICAL SYSTEMS**

<b>Compact Head-Up Display for General Aviation Aircraft</b> .....	965
<i>Dabby Tsadock, Yuval Artstein, Yoel Blumenfeld, Mordekhai Velger</i>	
<b>Terrestrial Demonstrator for Communication and Ranging Laser Inter-Satellite Link System</b> .....	973
<i>E. Pinsky, E. Shamay, D. Zehavi, M. Guelman, M. Orenstein</i>	
<b>Adaptation of LORD Obstacle Warning System Parameters to Helicopter/Pilot Flight Envelope Performance</b> .....	981
<i>A. Yaniv, V. Krupkin, A. Abitbol, J. Stern, Y. Shimoni, S. Biltz, A. Goldberg, B. Lubashitz, N. Zuntz, A. Zajdman</i>	

### **GNC IV**

<b>Time Efficient Closed Loop Steering Laws for Rigid Satellite Large Rotational Maneuver</b> .....	991
<i>Dov Verbin, Joseph Ben-Asher</i>	
<b>Capture-Guaranteeing Pursuer Linear Strategies</b> .....	1013
<i>Vladimir Turetsky, Valery Y. Glizer</i>	

### **STRUCTURES IV**

<b>Damaged Composites: The Behaviour of Laminated Composite Pre-Tensioned Plates Under Impact</b> .....	1038
<i>D. Mager, M. Mirkarimi, H. Abramovich</i>	
<b>Improved Computational Efficiency by Structural Reduction with Reference to Aeroelastic Applications</b> .....	1071
<i>V. Krylov, I. Harari</i>	
<b>Structural Airworthiness Assurance of Historic Aircraft</b> .....	1102
<i>Claudio Rodberg, Meir Myara</i>	
<b>Rectangular Composite Plates with Extension and Shear Piezoceramic Patches</b> .....	1112
<i>Lucy Edery-Azulay, Haim Abramovich</i>	

### **VORTICAL FLOWS & CFD III**

<b>Control of Vortex Breakdown in a Swirling Jet Using Buoyancy Effects</b> .....	1140
<i>D. Mourtazin, J. Cohen</i>	
<b>Study of an Artificially Generated Hairpin Vortex Using a Holographic PIV Method</b> .....	1153
<i>Alexander Svizher, Jacob Cohen</i>	
<b>On the Evolution of Amplitude Modulated Excitation in Still Air</b> .....	1192
<i>Tal Yehoshua, Avi Seifert</i>	
<b>CFD Analysis of Pylon Design for Aft Mounted Nacelle</b> .....	1221
<i>Ilan Darmon, Theodor Rubin</i>	
<b>Prediction of Slag Formation in a Solid Rocket Motor</b> .....	1228
<i>H. Wirzberger, Y. Macales, S. Yaniv</i>	

## **STRUCTURES V**

<b>Development of an Engineering Tool for Determining Repair Limitations of Fractured CH-53 Main Gearbox Housing Assembly</b> .....	1241
<i>Mikler Alexander, Klein Constantin, Margalit Avi, Arbel Sharon, Ankory Tzahi, Haim Cohen, Giorgio Gorge, Shinkopf Haim</i>	
<b>Development of a Numerical Tool for the Prediction of Fracture Progression and the Evaluation of Residual Strength in Randomly Perforated Structures</b> .....	1255
<i>Ilya Dukhovny, Constantine Klein, Sharon Arbel, Avi Margalit, Yevgeniy Movchan, Haim Sheinkopf, Tzahi Ankori</i>	
<b>Disbond Detection in Composite Adhesively Bonded T-Joints Using Vibration Signatures</b> .....	1267
<i>B. Whittingham, W.K. Chiu, I. Herszberg, M. Jones, H.C.H. Li</i>	
<b>A "Unified" and a "Kujawski Parameter" Crack Growth Models for Aluminum 2024-T351</b> .....	1289
<i>Giora Maymon</i>	
<b>Author Index</b>	