

21st IFAC Symposium on Automatic Control in Aerospace (ACA 2019)

IFAC PapersOnline Volume 52, Issue 12

Cranfield, United Kingdom
27 – 30 August 2019

Editor:

Antonios Tsourdos

ISBN: 978-1-7138-0754-4

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.

To the extent permissible under applicable laws, no responsibility is assumed by the Owner, the Publisher or the Licensee for any injury and/or damage to persons or property as a result of any actual or alleged libelous statements, infringement of intellectual property or privacy rights, or products liability, whether resulting from negligence or otherwise, or from any use or operation of any ideas, instructions, procedures, products or methods contained in the material therein.

The publication of an advertisement in the POD Edition does not constitute on the part of the Owner, the Publisher or the Licensee a guarantee or endorsement of the quality or value of the advertised products or services described therein or of any of the representations or the claims made by the advertisers with respect to such products or services.

Copyright© (2019) by IFAC (International Federation of Automatic Control)
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact the publisher, Elsevier Limited
at the address below.

Elsevier Limited
The Boulevard, Langford Lane
Kidlington
Oxford OX5 1GB UK

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
Web: www.proceedings.com

TABLE OF CONTENTS

ACTIVE SAMPLING-BASED DATA-DRIVEN REACHABILITY VERIFICATION FOR PROPORTIONAL NAVIGATION GUIDANCE LAW	1
<i>Suwon Lee, Seokwon Lee, Youdan Kim</i>	
PERFORMANCE ANALYSIS OF MODIFIED GAIN PSEUDO-MEASUREMENT FILTER FOR BALLISTIC TARGET TRACKING	7
<i>Dong-Yeon Lee, Seong-Min Hong, Min-Jea Tahk</i>	
COMPUTATIONAL GUIDANCE USING SPARSE GAUSS-HERMITE QUADRATURE DIFFERENTIAL DYNAMIC PROGRAMMING	13
<i>Shaoming He, Hyo-Sang Shin, Antonios Tsourdos</i>	
MISSILE INITIAL ENGAGEMENT DETERMINATION AND TERMINAL PHASE GUIDANCE	19
<i>A. Fariz, R. A. Sasongko</i>	
A SUPER-TWISTING SLIDING MODE CONTROL IN A BACKSTEPPING SETUP FOR RENDEZVOUS WITH A PASSIVE TARGET	25
<i>Jazmín Zenteno Torres, Jérôme Cieslak, David Henry, Jorge Dávila</i>	
FINITE HORIZON WORST CASE ANALYSIS OF LAUNCH VEHICLES	31
<i>Felix Biertümpfel, Harald Pfifer, Samir Bennani</i>	
STOCHASTIC OPTIMAL CONTROL FOR COLLISION AVOIDANCE AND LANDING	37
<i>Yuji Shimizu, Takeshi Tsuchiya</i>	
A METHOD FOR MISALIGNMENT CORRECTION OF STAR SENSORS	43
<i>Roland Strietzel</i>	
3D UAV NAVIGATION WITH MOVING-OBSTACLE AVOIDANCE USING BARRIER LYAPUNOV FUNCTIONS	49
<i>Esteban Restrepo, Ioannis Sarra, Antonio Loria, Julien Marzat</i>	
QUADROTOR TRAJECTORY GENERATION AND TRACKING FOR AGGRESSIVE MANEUVERS WITH ATTITUDE CONSTRAINTS	55
<i>Gan Yu, David Cabecinhas, Rita Cunha, Carlos Silvestre</i>	
SENSE AND AVOID USING HYBRID CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS	61
<i>Daniel Vidal Navarro, Chang-Hun Lee, Antonios Tsourdos</i>	
TRAJECTORY PLANNING OF THE UNMANNED AERIAL VEHICLES WITH ADAPTIVE CONVEX OPTIMIZATION METHOD	67
<i>Xin Sun, Senchun Chai, Baihai Zhang</i>	
SCALING OF COMMANDED SIGNALS IN A CASCADE CONTROL SYSTEM ADDRESSING VELOCITY AND ACCELERATION LIMITATIONS OF ROBOTIC UAVS	73
<i>Krzysztof Lakomy, Maciej Marcin Michalek, Wojciech Adamski</i>	
HIERARCHICAL MODEL PREDICTIVE CONTROL FOR AUTONOMOUS VEHICLE AREA COVERAGE	79
<i>M. Ibrahim, J. Matschek, B. Morabito, R. Findeisen</i>	
FINITE-TIME ATTITUDE TRACKING CONTROL METHOD OF MICROSATELLITE BASED ON ADAPTIVE ROBUSTNESS AND NEURAL NETWORK APPROXIMATION	85
<i>Zhang Kaicheng, Wang Feng</i>	
SPACE MICRO-LAUNCHER H_∞ CONTROL UNDER PARAMETRIC MODELING UNCERTAINTIES	91
<i>Sabin Diaconescu, Andrei Sperila, Bogdan D. Ciubotaru, Adrian M. Stoica</i>	
AN EVENT-TRIGGERED PREDICTIVE CONTROLLER FOR SPACECRAFT RENDEZVOUS HOVERING PHASES	97
<i>Julio C. Sanchez, Christophe Louembet, Francisco Gavilan, Rafael Vazquez</i>	
A COMPUTATIONALLY EFFICIENT MODEL PREDICTIVE CONTROL SCHEME FOR SPACE DEBRIS RENDEZVOUS	103
<i>Alexander Korsfeldt Larsén, Yutao Chen, Mattia Bruschetta, Ruggero Carli, Leonard Felicetti</i>	
INVERSE DYNAMICS BASED MODEL PREDICTIVE CONTROL FOR SPACECRAFT RAPID ATTITUDE MANEUVER	111
<i>Chao Song, Genaro Islas, Klaus Schilling</i>	
DEEP NEURAL NETWORK-BASED FEEDBACK CONTROL FOR DYNAMIC SOARING OF UNPOWERED AIRCRAFT	117
<i>Seong-Hun Kim, Jihoon Lee, Seungyun Jung, Hanna Lee, Youdan Kim</i>	

ROBUST C CONTROL LAW DESIGN AUGMENTED WITH LIDAR-BASED GUST INFORMATION	122
<i>Ryoichi Takase, Kento Fujita, Yoshiro Hamada, Takeshi Tsuchiya, Shinji Suzuki</i>	
GUST ALLEVIATION CONTROL USING PRIOR GUST INFORMATION: WIND TUNNEL TEST RESULTS.....	128
<i>Yoshiro Hamada, Kenichi Saitoh, Noboru Kobiki</i>	
TENSOR PRODUCT MODEL-BASED ROBUST FLUTTER CONTROL DESIGN FOR THE FLEXOP AIRCRAFT	134
<i>Béla Takarics, Bálint Vanek</i>	
ROBUST CONTROL BASED ON ADRC AND DOBC FOR SMALL-SCALE HELICOPTER	140
<i>Beomyeol Yu, Seungkeun Kim, Jinyoung Suk</i>	
ACTIVE FLUTTER SUPPRESSION: NON-STRUCTURED AND STRUCTURED H_∞ DESIGN	146
<i>Sérgio Waitman, Andrés Marcos</i>	
REINFORCEMENT OF A REFERENCE MODEL-BASED CONTROL USING ACTIVE DISTURBANCE REJECTION PRINCIPLE: APPLICATION TO QUADROTOR.....	152
<i>Y. Bouzid, H. Siguerdidjane, M. Guiatni, H. C Lamraoui</i>	
IMPROVED IMC-FILTER DESIGN TO IMC-PI EQUIVALENCE: APPLICATION TO QUADROTOR.....	158
<i>Y. Bouzid, H. Siguerdidjane, M. Zareb, Y. Bestaoui</i>	
EXPERIMENTAL VALIDATION OF LMI-BASED ANTI-WINDUP COMPENSATORS FOR ATTITUDE CONTROL IN MULTIROTOR UAVS	164
<i>Nicolò Buratti, Davide Invernizzi, Marco Lovera</i>	
MMAE/LQR YAW CONTROL SYSTEM OF A QUADROTOR FOR CONSTANT UNKNOWN INERTIA	170
<i>Pedro Outeiro, Carlos Carneira, Paulo Oliveira</i>	
LINEAR QUADRATIC REGULATOR FOR TRAJECTORY TRACKING OF A QUADROTOR	176
<i>Luís Martins, Carlos Carneira, Paulo Oliveira</i>	
ACTIVE FAULT-TOLERANT GYROMOMENT CONTROL OF SATELLITES AND FREE-FLYING ROBOTS.....	182
<i>N. Rodnishchev, Ye. Somov, S. Butyrin, S. Somov</i>	
RELIABLE CONTROL OPTIMIZATION IN AEROSPACE ENGINEERING AT STOCHASTIC STREAM OF FAULTS	188
<i>N. Rodnishchev, Ye. Somov, S. Butyrin, T. Somova</i>	
NOVEL NON-MODEL-BASED FAULT DETECTION AND ISOLATION OF SATELLITE REACTION WHEELS BASED ON A MIXED-LEARNING FUSION FRAMEWORK.....	194
<i>Hasan Abbasi Nozari, Paolo Castaldi, Hamed Dehghan Banadaki, Silvio Simani</i>	
FAULT ANALYSIS TO IMPROVE RELIABILITY OF A LEO SATELLITE EPS	200
<i>E. Mostacciolo, F. Vasca, S. Baccari, L. Iannelli, V. Stanzione</i>	
COOPERATIVE STATE AND FAULT ESTIMATION OF FORMATION FLIGHT OF SATELLITES IN DEEP SPACE SUBJECT TO UNRELIABLE INFORMATION.....	206
<i>S. M. Azizi, K. Khorasani</i>	
H_∞/LQR OPTIMAL CONTROL FOR A SUPERSONIC AIR-BREATHING MISSILE OF ASYMMETRIC CONFIGURATION	214
<i>Raymond Vin Vincent, John Economou, David Galvao Wall, John Cleminson</i>	
NONLINEAR ROBUST GENERALIZED DYNAMIC INVERSION BASED HOMING GUIDANCE AND CONTROL OF AERIAL INTERCEPTORS	219
<i>Uzair Ansari, Abdulrahman H. Bajodah, Belkacem Kada</i>	
STAGE OPTIMIZATION OF ANTI-AIR MISSILES CONSIDERING GUIDANCE LAWS	227
<i>Seong-Min Hong, Dong-Yeon Lee, Min-Jea Tahk</i>	
ROBUST DESIGN FOR THE ROLL-CHANNEL AUTOPILOT OF A CANARD-GUIDED DUAL-SPIN PROJECTILE.....	232
<i>Sovanna Thai, Spilios Theodoulis, Clément Roos, Jean-Marc Biannic</i>	
ENSURING OF RELATIVE NAVIGATION AND CONTROL OF LOW-ORBITAL MICROSATELLITES FORMATION IN THE TASK OF REMOTE CONTROL OF ROBOTS.....	238
<i>Alexander V. Nebylov, Vladimir V. Perliouk, Hamza Benzerrouk</i>	
OPTIMIZATION OF THE CONTROL SYSTEM FOR COLLECTING A GROUP OF VEHICLES	244
<i>Aleksandr I. Panferov, Alexander V. Nebylov, Sergey A. Brodsky</i>	
ENERGY MANAGEMENT AND GUIDANCE FOR GYROPLANE AUTONOMOUS UNPOWERED LANDING BASED ON ONBOARD TRAJECTORY GENERATION.....	250
<i>Xiaoxing Fang, Hamza Benzerrouk, René Jr. Landry</i>	
THE WIG-CRAFT AERODYNAMIC MODEL PARAMETERS CALCULATION.....	256
<i>Sergey A. Brodsky, Alexander V. Nebylov, Alexander I. Panferov</i>	

SHAFT SPEED CONTROL OF LABORATORY GAS TURBINE ENGINE	262
<i>Richa Singh, Arnab Maity, P. S. V. Nataraj</i>	
AN MPC APPROACH TO TRANSIENT CONTROL OF LIQUID-PROPELLANT ROCKET ENGINES	268
<i>Sergio Pérez-Roca, Julien Marzat, Émilien Flayac, Hélène Piet-Lahanier, Serge Le Gonidec</i>	
ASCENT TRAJECTORY OPTIMIZATION OF LAUNCH VEHICLES WITH AIR-BREATHING PROPULSION	274
<i>Vijith Mukundan, Arnab Maity, Shashi Ranjan Kumar, U P Rajeev</i>	
CRYOGENIC LIQUID ROCKET ENGINE TEST BENCH FAULT-TOLERANT CONTROL SYSTEM: COOLING SYSTEM APPLICATION	280
<i>C. Sarotte, J. Marzat, H. Piet Lahanier, M. Galeotta, G. Ordonneau</i>	
PROPELLANT SLOSHING TORQUE H_{∞} – BASED OBSERVER DESIGN FOR ENHANCED ATTITUDE CONTROL	286
<i>Anthony Bourdelle, Jean-Marc Biannic, Helene Evain, Sabine Moreno, Laurent Burlion</i>	
PERFORMANCE EVALUATION OF LEARNING-BASED CHANNEL PREDICTION FOR COMMUNICATION RELAY UAVS IN URBAN ENVIRONMENTS	292
<i>Pawel Ladosz, Jongyun Kim, Hyondong Oh, Wen-Hua Chen</i>	
FAST TRAJECTORY OPTIMIZATION USING SEQUENTIAL CONVEX PROGRAMMING WITH NO-FLY ZONE CONSTRAINTS	298
<i>Young-Jae Oh, Heekun Roh, Min-Jea Tahk</i>	
COMBINING HOMOGENEOUS HIGH ORDER SLIDING MODE AND NONLINEAR DYNAMIC INVERSION FOR FIXED WING AIRCRAFT ATTITUDE AND SPEED CONTROL	304
<i>A. Hamissi, Y. Bouzid, N. Dabouze, M. Zaouche, M. Hamerain</i>	
EVOLUTIONARY GAME THEORY BASED MULTI-OBJECTIVE OPTIMIZATION FOR CONTROL ALLOCATION OF OVER-ACTUATED SYSTEM	310
<i>On Park, Hyo-Sang Shin, Antonious Thourdos</i>	
AUTOMATIC THREE-POINT LANDING OF A UAV WITH H_{∞}-CONTROL IN D-IMPLEMENTATION	316
<i>Nicolas Sedlmair, Julian Theis, Frank Thielecke</i>	
RESEARCH ON SPEED OSCILLATION OF ULTRA-LOW SPEED TURNABLE IN AEROSPACE DUE TO LIMITED RESOLUTION ENCODER	322
<i>Lidong Li, Le Pei, Feng Wang</i>	
POSITION, SIZE AND ORIENTATION ESTIMATION OF GROUND OBSTACLES IN SENSE AND AVOID	328
<i>Peter Bauer</i>	
TRAJECTORY PLANNING AND CONTROL FOR DRONE REPLACEMENT FOR MULTIDRONE CINEMATOGRAPHY	334
<i>Marta Marques, Bruno J. Guerreiro, Rita Cunha, Carlos Silvestre</i>	
COOPERATIVE GUIDANCE OF A FLEET OF UAVS FOR MULTI-TARGET DISCOVERY AND TRACKING IN PRESENCE OF OBSTACLES USING A SET MEMBERSHIP APPROACH	340
<i>Léon Reboul, Michel Kieffer, Hélène Piet-Lahanier, Sébastien Reynaud</i>	
HIERARCHIC STABILIZATION OF FLYING CONVEX-PATH-FOLLOWING FORMATIONS PART I: FULLY-ACTUATED AGENTS	346
<i>Mohamed I. El-Hawwary</i>	
HIERARCHIC STABILIZATION OF FLYING CONVEX-PATH-FOLLOWING FORMATIONS PART II: UNDERACTUATED AGENTS	352
<i>Mohamed I. El-Hawwary</i>	
MULTI-VEHICLE COOPERATIVE CONTROL FOR LOAD TRANSPORTATION	358
<i>Tiago Valentim, Rita Cunha, Paulo Oliveira, David Cabecinhas, Carlos Silvestre</i>	
COLLISION-FREE DECENTRALISED DENSITY FEEDBACK CONTROL FOR SWARMS	364
<i>Utku Eren, Emma Hansen</i>	
AREA COVERAGE BY A GROUP OF UAVS USING THE BROADCAST CONTROL FRAMEWORK	370
<i>Shalini Darmaraju, Madhavan Shanmugavel, Md Abdus Samad Kamal, Chee Pin Tan</i>	
RUNWAY RELATIVE POSITIONING OF AIRCRAFT WITH IMU-CAMERA DATA FUSION	376
<i>Tamas Grof, Peter Bauer, Antal Hiba, Attila Gati, Balint Vanek</i>	
SYSTEM IDENTIFICATION AND FEEDFORWARD CONTROL OF A FATIGUE STRUCTURAL TESTING RIG: THE SINGLE ACTUATOR CASE	382
<i>Robyn Fortune, C. André Beltempo, James Richard Forbes</i>	
VISION-AIDED COMPLEMENTARY FILTER FOR ATTITUDE AND POSITION ESTIMATION: DESIGN, ANALYSIS AND EXPERIMENTAL VALIDATION	388
<i>João Madeiras, Carlos Cardeira, Paulo Oliveira</i>	

MODEL-BASED DEPENDABILITY ANALYSIS OF FAULT-TOLERANT INERTIAL NAVIGATION SYSTEM: A PRACTICAL EXPERIENCE REPORT	394
<i>Mikael Steurer, Andrey Morozov, Klaus Janschek, Klaus-Peter Neitzke</i>	
A KALMAN FILTERING APPROACH FOR SYSTEMS SUBJECT TO PARAMETRIC MODELING UNCERTAINTIES	400
<i>Adrian M. Stoica, Teodor V. Chelaru, Florin Stoican, Bogdan D. Ciubotaru</i>	
CLOSED-LOOP ANALYSIS WITH INCREMENTAL BACKSTEPPING CONTROLLER CONSIDERING MEASUREMENT BIAS	405
<i>Byoung-Ju Jeon, Min-Guk Seo, Hyo-Sang Shin, Antonios Tsourdos</i>	
TWO-LAYER ON-LINE PARAMETER ESTIMATION FOR ADAPTIVE INCREMENTAL BACKSTEPPING FLIGHT CONTROL FOR A TRANSPORT AIRCRAFT IN UNCERTAIN CONDITIONS	411
<i>Dmitry I. Ignatyev, Hyo-Sang Shin, Antonios Tsourdos</i>	
ADDRESSING ACTUATION REDUNDANCIES IN INCREMENTAL CONTROLLERS FOR ATTITUDE TRACKING OF FIXED-WING AIRCRAFT	417
<i>Rafael A. Cordeiro, José R. Azinheira, Alexandra Moutinho</i>	
TOWARDS RESILIENT UAV: ESCAPE TIME IN GPS DENIED ENVIRONMENT WITH SENSOR DRIFT	423
<i>Hyung-Jin Yoon, Wenbin Wan, Hunmin Kim, Naira Hovakimyan, Petros G. Voulgaris</i>	
INTEGRATION OF PHASE PLANE FLIGHT ENVELOPE PROTECTIONS IN CASCADED INCREMENTAL FLIGHT CONTROL	429
<i>Agnes Christine Gabrys, Rasmus Steffensen, Rafael De Angelis Cordeiro, José Raul Azinheira, Florian Holzapfel</i>	
MODEL-BASED FDI FOR AGILE SPACECRAFT WITH MULTIPLE ACTUATORS WORKING SIMULTANEOUSLY	436
<i>E. Lopez-Encarnacion, R. Fonod, P. Bergner</i>	
ATTITUDE STABILIZATION OF INERTIAL POINTING SPACECRAFT USING MAGNETIC ACTUATORS	442
<i>Davide Invernizzi, Marco Lovera</i>	
SDRE CONTROL WITH NONLINEAR J2 PERTURBATIONS FOR NANOSATELLITE FORMATION FLYING	448
<i>Mohd Bilal, Ria Vijayan, Klaus Schilling</i>	
ROBUST H_∞ COMPUTED TORQUE CONTROL OF FLEXIBLE JOINT TVC SYSTEMS	454
<i>A. Aydogan, O. Hasturk, E. Rogers</i>	
PREPARATION OF PAPERS FOR IFAC CONFERENCES & SYMPOSIA: AUTONOMOUS DISTRIBUTION ALGORITHM FOR FORMATION SATELLITES UNDER EMERGENT IMAGING REQUESTS	460
<i>A. Miao Yue, B. Wang Feng, C. Chen Xueqin, D. Yu Yanjun, E. Li Chaoyong</i>	
A DESIGN OF A SHORT COURSE WITH COTS UAV SYSTEM FOR HIGHER EDUCATION STUDENTS	466
<i>Ju-Hyeon Hong, Hyo-Sang Shin, Antonios Tsourdos</i>	
CONTROL TECHNOLOGIES AND INSTRUMENTATION IN AEROSPACE ENGINEERING	472
<i>Alexander V. Nebylov</i>	
CONVERTIBLE DELTA-WING AIRCRAFT FOR TEACHING AND RESEARCH	478
<i>Tudor-Bogdan Airimitoae, Christophe Farges, Loic Lavigne, Franck Cazaurang</i>	
AN EXPERIENCE OF PROJECT BASED LEARNING IN AEROSPACE ENGINEERING	484
<i>Paolo Castaldi, Nicola Mimmo</i>	
UAV LAB: A MULTIDISCIPLINARY UAV DESIGN COURSE	490
<i>Mattia Giurato, Paolo Gattazzo, Marco Lovera</i>	
LEO SATELLITES BASED DOPPLER POSITIONING USING DISTRIBUTED NONLINEAR ESTIMATION	496
<i>Hamza Benzerrouk, Quang Nguyen, Fang Xiaoxing, Abdessamad Amrhar, Rene. Jr Landry</i>	
APPLICATION OF LQG AND H_∞ GAIN SCHEDULING TECHNIQUES TO ACTIVE SUPPRESSION OF FLUTTER	502
<i>Miguel Á Rosique, Raheeg Alamin, James F Whidborne</i>	
ADAPTIVE CONTROL OF NOVEL CONFIGURATION WITH MOVING MASS	508
<i>Jianqing Li, Chaoyong Li, Feng Wang</i>	
CO-DESIGN OF AIRCRAFT VERTICAL TAIL AND CONTROL LAWS USING DISTRIBUTED ELECTRIC PROPULSION	514
<i>E. Nguyen Van, D. Alazard, C. Döll, P. Pastor</i>	
A NEW CONTROL ALLOCATION ALGORITHM TO IMPROVE RUNWAY CENTERLINE TRACKING AT LANDING	520
<i>Edouard Sadien, Clément Roos, Abderazik Birouche, Mathieu Carton, Michel Basset</i>	

VALIDATION OF CONTROL LAWS AT HIGH ANGLES OF ATTACK USING THREE- DEGREE-OF-FREEDOM DYNAMIC RIG IN WIND TUNNEL	526
<i>Maria E. Sidoryuk, Alexander N. Khrabrov, Timur G. Mukhanov, Igor I. Grishin</i>	
OPTIMAL GUIDANCE FOR 1ST STAGE LAUNCHER RECOVERY	532
<i>Martine Ganet-Schoeller, Adrien Brunel</i>	
GUIDANCE AND CONTROL OF A SPACE ROBOT-MANIPULATOR AT APPROACH AND CAPTURING A PASSIVE SATELLITE	538
<i>Ye. Somov, S. Butyrin, S. Somov</i>	
DIGITAL AND PULSE-WIDTH CONTROL OF THE SATELLITES AND SPACE ROBOTS ORIENTATION IN INITIAL MODES	544
<i>Ye. Somov, S. Butyrin, T. Somova</i>	
MODEL BASED DRIVING ANALYSIS FOR A NOVEL STEPPED ROTARY FLOW CONTROL VALVE	549
<i>Karem Abuowda, Siamak Noroozi, Mihai Dupac, Phil Godfrey</i>	
NEW TECHNIQUE FOR DEPLOYING LONG COILABLE BOOMS, WITHOUT BLOSSOMING EFFECT, USING A POLYMER JOINT	555
<i>A. Cornogolub</i>	
Author Index	