

2022 International Conference on Unmanned Aircraft Systems (ICUAS 2022)

**Dubrovnik, Croatia
21-24 June 2022**

Pages 1-838



**IEEE Catalog Number: CFP22VAD-POD
ISBN: 978-1-6654-0594-2**

**Copyright © 2022 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP22VAD-POD
ISBN (Print-On-Demand):	978-1-6654-0594-2
ISBN (Online):	978-1-6654-0593-5
ISSN:	2373-6720

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
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

Design and Flight Testing of a Two DOF Decoupled Pantograph Aerial Manipulator for Commercial UAVs	1
<i>C. Luxton, J. Sandino, F. Vanegas, F. Gonzalez</i>	
Gaussian Process Regression-Augmented Nonlinear Model Predictive Control for Quadrotor Object Grasping	11
<i>Wei Luo, Hannes Eschmann, Peter Eberhard</i>	
Design and Flight Test of an Aerial Manipulator for Applications in GPS-Denied Environments	20
<i>M. Ng, F. Vanegas, K. Morton, J. Sandino, F. Gonzalez</i>	
Aerial Device Delivery for Power Line Inspection and Maintenance	30
<i>Alejandro Suarez, Rafael Salmoral, Ambar Garofano-Soldado, Guillermo Heredia, Anibal Ollero</i>	
Three Fundamental Paradigms for Aerial Physical Interaction Using Nonlinear Model Predictive Control	39
<i>Ayham Alharbat, Hanieh Esmaeeli, Davide Bicego, Abeje Mersha, Antonio Franchi</i>	
An Energy Analysis of Quadrotors with Cable-Suspended Payloads	49
<i>Hassan Alkomy, Jinjun Shan</i>	
How to Stay Well Clear in Corridors and Swarms: Detect-And-Avoid Ranges for Geovectoring Concepts	57
<i>Niklas Peinecke</i>	
A Proposal for a Common Metric for Drone Traffic Density	64
<i>Ole Henrik Dahle, Joakim Rydberg, Martin Dullweber, Niklas Peinecke, Aurelie Aurilla Arntzen Bechina</i>	
A Model for a Safer Drone's Operation in an Urban Environment	73
<i>Aurelie Aurilla Arntzen Bechina, Esther Nistal Cabanas, Serkan Guldal, Ole Henrik Dahle, Jeronimo Bueno, Martin Dullweber, Sebastian Giersch, Manon Coyne</i>	
Machine Learning Attempt to Conflict Detection for UAV with System Failure in U-Space: Recurrent Neural Network, RNNn	78
<i>Rina Komatsu, Aurelie Aurilla Arntzen Bechina, Serkan Guldal, Merivan Sasmaz</i>	
A Lightweight Device for Energy Harvesting from Power Lines with a Fixed-Wing UAV	86
<i>William Stewart, Dario Floreano, Emad Ebeid</i>	
Design of a Tactical eVTOL UAV with a Hydrogen Fuel Cell	94
<i>Vasco Coelho, Pedro Silva, Paulo Sa, Joao Caetano, Luis Felix, Frederico Afonso, Andre Marta</i>	
Heterogenous Vehicle Routing: Comparing Parameter Tuning Using Genetic Algorithm and Bayesian Optimization	104
<i>Subramanian Ramasamy, Md Safwan Mondal, Jean-Paul F. Reddinger, James M. Dotterweich, James D. Humann, Marshal A. Childers, Pranav A. Bhounsule</i>	

A Genetic Algorithm Enhanced with Fuzzy-Logic for Multi-objective Unmanned Aircraft Vehicle Path Planning Missions	114
<i>Charis Ntakolia, Konstantinos S. Platanitis, Georgios P. Kladis, Christos Skliros, Anastasios D. Zagorianos</i>	
UAV Path Planning for Offshore Swarm-Based Missions*.....	124
<i>Konstantinos S. Platanitis, Georgios P. Kladis, Evangelos Petrongonas, Christos Skliros, Nikos C. Tsourveloudis, Anastasios D. Zagorianos</i>	
Multidisciplinary Optimisation of an eVTOL UAV with a Hydrogen Fuel Cell	134
<i>Bernardo Alves, Andre Marta, Luis Felix</i>	
A Dataset of Stationary, Fixed-Wing Aircraft on a Collision Course for Vision-Based Sense and Avoid.....	144
<i>J. Martin, J. Riseley, J. J. Ford</i>	
Dynamic Obstacle Avoidance of Quadcopters with Monocular Camera Based on Image-Based Visual Servo	150
<i>Junqing Ning, Haotian Zhang, Quan Quan</i>	
Detection and Tracking of Non-Cooperative Flying Obstacles Using Low SWaP Radar and Optical Sensors: An Experimental Analysis	157
<i>Federica Vitiello, Flavia Causa, Roberto Opromolla, Giancarmine Fasano</i>	
Deployment of Reliable Visual Inertial Odometry Approaches for Unmanned Aerial Vehicles in Real-World Environment	167
<i>Jan Bednar, Matej Petrlik, Kelen Cristiane Teixeira Vivaldini, Martin Saska</i>	
Evenly Weighted Particle Filter for Terrain-Referenced Navigation Using Gaussian Mixture Proposal Distribution.....	177
<i>Junwoo Park, Hyochoong Bang</i>	
Error State Extended Kalman Filter Multi-Sensor Fusion for Unmanned Aerial Vehicle Localization in GPS and Magnetometer Denied Indoor Environments	184
<i>Lovro Markovic, Marin Kovac, Robert Milijas, Marko Car, Stjepan Bogdan</i>	
Leonardo Drone Contest 2021: Politecnico Di Milano Team Architecture	191
<i>Gabriele Roggi, Salvatore Meraglia, Marco Lovera</i>	
Dual-Axis Tilting Rotor Quad-Plane Design, Simulation, Flight, and Performance Comparison with a Conventional Quad-plane Design.....	197
<i>Alessandro Mancinelli, Ewoud J. J. Smeur, Bart Remes, Guido De Croon</i>	
Autonomous Drone-Based Antenna Radiation Pattern Characterization	207
<i>Muhammad Owais, Henrik Midtiby, Diana Trifon, Agus Hasan</i>	
Autonomous Landing and Avoidance System Virtual Validation Approach.....	214
<i>O. Ipas, M. Przylecki, E. Soria, A. Albeniz, A. Bernardini, A. Barrio</i>	
Pheromone-Based Approach for Scalable Task Allocation.....	220
<i>Wai Lun Leong, Jiawei Cao, Sunan Huang, Rodney Teo</i>	
Learning-Based Distributed Control for UAVs to Achieve Fully Connected Effect Using Local Information.....	228
<i>Eshaan Khanapuri, Rajnikant Sharma</i>	

Integrated Solar Power Harvesting and Hibernation for a Recurrent-Mission VTOL Micro Aerial Vehicle	237
<i>Stephen J. Carlson, Tolga Karakurt, Prateek Arora, Christos Papachristos</i>	
Flight Control for Quadrotor Safety in the Presence of CoG Shift and Loss of Motor Efficiency	245
<i>Jindou Jia, Kexin Guo, Chenliang Wang, Ning Shen, Wei Jia, Xiang Yu</i>	
Deep-Learned Autonomous Landing Site Discovery for a Tiltrotor Micro Aerial Vehicle	255
<i>Prateek Arora, Stephen J. Carlson, Tolga Karakurt, Christos Papachristos</i>	
Hardware-In-the-loop Simulation for Quadrotor Fault Diagnosis Enhancing Airworthiness Using OS-Fuzzy-ELM	263
<i>Thanaraj T, Sidharth Sai, Bing Feng Ng, Kin Huat Low</i>	
Obstacle-Aware UAV Navigation Based on a Leader-follower Consensus Protocol	273
<i>E. U. Rojo-Rodriguez, E. G. Rojo-Rodriguez, E. J. Ollervides-Vazquez, P. Castillo, O. Garcia-Salazar</i>	
Bio-Inspired Source Seeking and Obstacle Avoidance on a Palm-sized Drone	282
<i>Nishant Elkunchwar, Vikram Iyer, Melanie Anderson, Krishna Balasubramanian, Jessica Noe, Yash Talwekar, Sawyer Fuller</i>	
Wind Tunnel Testing of an Avian-Inspired Morphing Wing with Distributed Pressure Sensing	290
<i>Mario Martinez Groves-Raines, Sergio A. Araujo-Estrada, Abdulghani Mohamed, Simon Watkins, Shane P. Windsor</i>	
Swarming of Unmanned Aerial Vehicles by Sharing Distributed Observations of Workspace	300
<i>Martin Krizek, Jiri Horyna, Martin Saska</i>	
Fuselage Aerodynamics and Weight Trade-Off at Low-Speed Ornithopter Flight	310
<i>E. Sanchez-Laulhe, C. Ruiz, J. A. Acosta, A. Ollero</i>	
Urban Swarm Navigation Exploiting sUAS Collaboration and Cognition	319
<i>Maarten Uijt De Haag, Mats Martens, Svenja Huschbeck</i>	
Design, Development and Testing of a Hybrid Fixed-Flapping Wing UAV	329
<i>J. A. Moreno, C. Ruiz, A. Satue, J. A Acosta, A. Ollero</i>	
Discrete Assembly of Unmanned Aerial Systems	339
<i>Christopher G. Cameron, Zach Fredin, Neil Gershenfeld</i>	
Trajectory Tracking Control of a Quadrotor UAV Using an Auto-Tuning Robust Sliding Mode Controller	345
<i>Subhash Chand Yogi, Archit Krishna Kamath, Padmini Singh, Laxmidhar Behera</i>	
H_{∞} -Based Transfer Learning for UAV Trajectory Tracking	354
<i>Vincenzo Luigi Donatone, Salvatore Meraglia, Marco Lovera</i>	
Flatness-Based Motion Control of a UAV Slung Load System Using Quasi-Static Feedback Linearization	361
<i>Zifei Jiang, Mohamed Al Lawati, Arash Mohammadhasani, Alan F. Lynch</i>	
Euler-Lagrange Modeling and Control of Quadrotor UAV with Aerodynamic Compensation	369
<i>Simone Martini, Serhat Sönmez, Alessandro Rizzo, Margareta Stefanovic, Matt J. Rutherford, Kimon P. Valavanis</i>	

Neural Enhanced Control for Quadrotor Linear Behavior Fitting	378
<i>Esteban Carvalho, Pierre Susbielle, Ahmad Hably, Jilles S. Dibangoye, Nicolas Marchand</i>	
Towards Finding Energy Efficient Paths for Hybrid Airships in the Atmosphere of Venus.....	386
<i>Bernardo Martinez, Anna Puigvert I Juan, Guilherme A. S. Pereira</i>	
Path Planning with Potential Field-Based Obstacle Avoidance in a 3D Environment by an Unmanned Aerial Vehicle	394
<i>Ana Batinovic, Jurica Goricanec, Lovro Markovic, Stjepan Bogdan</i>	
Plannie: A Benchmark Framework for Autonomous Robots Path Planning Algorithms Integrated to Simulated and Real Environments	402
<i>Lidia Rocha, Kelen Vivaldini</i>	
A 3D Benchmark for UAV Path Planning Algorithms: Missions Complexity, Evaluation and Performance.....	412
<i>Lidia Rocha, Kelen Vivaldini</i>	
Q-Learning Based Path Planning Method for UAVs Using Priority Shifting	421
<i>Kevin B. De Carvalho, Iure Rosa L. De Oliveira, Daniel K. D. Villa, Alexandre G. Caldeira, Mario Sarcinelli-Filho, Alexandre S. Brandao</i>	
Implementation of the Rapidly-Exploring Random Belief Tree and Statistical Analysis of Functionality.....	427
<i>Timothy I Machin, Robert C Leishman</i>	
Validation of Two-Wire Power Line UAV Localization Based on the Magnetic Field Strength	434
<i>Goran Vasiljevic, Dean Martinovic, Matko Batos, Stjepan Bogdan</i>	
Strategic Conflict Management for Performance-Based Urban Air Mobility Operations with Multi- agent Reinforcement Learning	442
<i>Cheng Huang, Ivan Petrunin, Antonios Tsourdos</i>	
Autonomous Drone Delivery to Your Door and Yard.....	452
<i>Shyam Sundar Kannan, Byung-Cheol Min</i>	
Building Trust with a Mobile Application for Last-Mile Commercial Drone Delivery	462
<i>Jurgen Famula, Daniel E. Pittman, Kerstin S. Haring</i>	
A Pressure Washing Hosing-Drone – Mitigating Reaction Forces and Torques.....	468
<i>Blake Hament, Paul Oh</i>	
Real-Time LiDAR-based Semantic Classification for Powerline Inspection.....	478
<i>V. Valseca, J. Paneque, J. R. Martinez-De Dios, A. Ollero</i>	
Quantitative and Qualitative Assessment of Indoor Exploration Algorithms for Autonomous UAVs	487
<i>Adil Farooq, Christos Laoudias, Panayiotis S. Kolios, Theocharis Theocharides</i>	
An Incrementally Deployed Swarm of MAVs for Localization Using Ultra-Wideband	497
<i>Dominik Natter, Klaus Ening, Claudio Paliotta</i>	
Modeling of the Skywalker X8 Fixed-Wing UAV: Flight Tests and System Identification	506
<i>Dirk Reinhardt, Kristoffer Gryte, Tor Arne Johansen</i>	
The Tailsitter Autogiro UAV: Modeling, Design, and CFD Simulation.....	516
<i>C. Gellida-Coutino, V. Dominguez-De La Cruz, A. Sanchez-Orta, O. Garcia-Salazar, P. Castillo</i>	

Cooperative Navigation and Guidance of a Micro-Scale Aerial Vehicle by an Accompanying UAV Using 3D LiDAR Relative Localization.....	526
<i>Vaclav Pritzl, Matous Vrba, Petr Stepan, Martin Saska</i>	
RMF-Owl: A Collision-Tolerant Flying Robot for Autonomous Subterranean Exploration	536
<i>Paolo De Petris, Huan Nguyen, Mihir Dharmadhikari, Mihir Kulkarni, Nikhil Khedekar, Frank Mascariich, Kostas Alexis</i>	
Controlling a Swarm of Unmanned Aerial Vehicles Using Full-Body k-Nearest Neighbor Based Action Classifier.....	544
<i>Akash Chaudhary, Tiago Nascimento, Martin Saska</i>	
WTA/TLA: A UAV-Captured Dataset for Semantic Segmentation of Energy Infrastructure	552
<i>Georgios Zampokas, Evangelos Skartados, Dimitrios Alexiou, Kosmas Tsiakas, Ioannis Tzanakis, Nikolaos Roussos, Dimitrios Giakoumis, Ioannis Kostavelis, Christos-Savvas Bouganis, Dimitrios Tzovaras</i>	
Drone Collision Detection and Classification Using Proprioceptive Data	562
<i>Rogério R. Lima, Guilherme A. S. Pereira</i>	
Siamese Adaptive Transformer Network for Real-Time Aerial Tracking.....	570
<i>Daitao Xing, Athanasios Tsoukalas, Nikolaos Evangeliou, Nikolaos Giakoumidis, Anthony Tzes</i>	
Detection and Tracking of Rogue UASs Using a Novel Real-Time Passive Radar System	576
<i>Nicolas Souli, Ilias Theodorou, Panayiotis Kolios, Georgios Ellinas</i>	
Radar-Inertial State-Estimation for UAV Motion in Highly Agile Manoeuvres.....	583
<i>Jan Michalczyk, Christian Schöffmann, Alessandro Fornasier, Jan Steinbrener, Stephan Weiss</i>	
Towards Online System Identification: Benchmark of Model Identification Techniques for Variable Dynamics UAV Applications	590
<i>Junlin Song, Pedro J. Sanchez-Cuevas, Miguel Olivares-Mendez</i>	
AI-Based Fault-tolerant Controller Design for Handling Both Actuator and Sensor Faults of Multirotors.....	599
<i>S. Huang, F. Liao, R. Teo</i>	
Hexarotor Fault Tolerant Control Using a Bank of Disturbance Observers	608
<i>Alessandro Baldini, Riccardo Felicetti, Alessandro Freddi, Sauro Longhi, Andrea Monteriu</i>	
A Hybrid Polynomial Stall Model for the Longitudinal Dynamics of a UAV	617
<i>Vincent Guibert, Jean-Philippe Condomines, Mathieu Brunot, Jean-Marc Biannic, Murat Bronz</i>	
Experimental Investigation of EMC Weaknesses in UAVs During Overhead Power Line Inspection.....	626
<i>Martin Skriver, Anders Stengaard, Ulrik Pagh Schultz, Emad Ebeid</i>	
An Integrated Modelling Framework for Drone-Based Flood Monitoring	636
<i>Stylianos Exadaktulos, Panayiotis Kolios, Demetrios G. Eliades</i>	
Distributed Trajectory Planning for a Formation of Aerial Vehicles Inspecting Wind Turbines	646
<i>Damian Perez, Alfonso Alcantara, Jesus Capitan</i>	
Multi-Agent Path Planning and Trajectory Generation for Confined Environments	655
<i>Hikmet Beyoglu, Stephan Weiss, Bernhard Rinner</i>	

Generalized Lazy-Theta for 3D Path Planning Considering Non-uniform Costs.....	664
<i>Rafael Rey, Jose A. Cobano, L. Merino, F. Caballero</i>	
Decoupled SCP-Based Trajectory Planning in the Complex Environment for Multiple Fixed-wing UAV Systems.....	670
<i>Feng Zhao, Jianglong Yu, Yongzhao Hua, Xiwang Dong, Qingdong Li, Zhang Ren</i>	
Modified Constrained Wavefront Expansion Path Planning Algorithm for Tilt-Wing UAV	676
<i>Lennart Danielmeier, Sebastian Seitz, Isabelle Barz, Philipp Hartmann, Max Hartmann, Dieter Moormann</i>	
Fighter Pilot Behavior Cloning.....	686
<i>Viktor Sandström, Linus Luotsinen, Daniel Oskarsson</i>	
Flight Dynamics Modeling and Control of a New Type High-Speed Helicopter in Take-off and Landing.....	696
<i>Honggang Gao, Haobo Shi, Xu Zou</i>	
Smart Anomaly Detection and Monitoring of Industry 4.0 by Drones	705
<i>William Pensec, David Espes, Catherine Dezan</i>	
The Spectrum Policy Challenges of Unmanned Traffic Management and U-Space Regulation - Stakeholder Analysis View	714
<i>Pekka Ojanen, Seppo Yrjölä</i>	
Toward Nonlinear Flight Control for Fixed-Wing UAVs: System Architecture, Field Experiments, and Lessons Learned	724
<i>Erlend M. Coates, Dirk Reinhardt, Kristoffer Gryte, Tor Arne Johansen</i>	
DJI Tello Quadrotor as a Platform for Research and Education in Mobile Robotics and Control Engineering	735
<i>Wojciech Giernacki, Jinjun Rao, Sasa Sladic, Adam Bondyra, Marek Retinger, Tadeo Espinoza-Fraire</i>	
Implementation and Tests of an INDI Control Strategy Applied to the Parrot Mambo Minidrone	745
<i>Gilles Delansnay, Alain Vande Wouwer</i>	
Obstacle Avoidance for a Heterogeneous Formation Using the Null Space-Based Behavioral Approach and Potential Fields.....	753
<i>Mauro Sergio Mafra Moreira, Mario Sarcinelli-Filho</i>	
Xhaul Latency Dimensioning of 5G Drone Control.....	762
<i>Line M. P. Larsen, Aleksander Pruski, Henrik L. Christiansen, Sarah Ruepp, Michael S. Berger</i>	
Leader-Follower UGV-UAV Formation as Control Paradigm for Package Delivery	772
<i>Vinicius Pacheco Bacheti, Alexandre Santos Brandao, Mario Sarcinelli-Filho</i>	
A Comparative Analysis of Turbulence Models in FLUENT for High-Lift Airfoils at Low Reynolds Number.....	779
<i>Mughees Ahmad, Boyang Li</i>	
Render-In-the-loop Aerial Robotics Simulator: Case Study on Yield Estimation in Indoor Agriculture.....	787
<i>Antun Ivanovic, Marsela Polic, Jelena Tabak, Matko Orsag</i>	

Sim-In-Real: Digital Twin Based UAV Inspection Process.....	794
<i>Jihan Zhang, Ruoyu Wang, Guidong Yang, Kangcheng Liu, Chuanxiang Gao, Yu Zhai, Xi Chen, Ben M. Chen</i>	
In-Flight Validation of Propeller Slipstream Model.....	802
<i>Jackson Empey, Meyer Nahon</i>	
Impact of the Trajectory on the Performance of RGB-D SLAM Executed by a UAV in a Subterranean Environment	812
<i>Kieren Y. Samarakoon, Guilherme A. S. Pereira, Jason N. Gross</i>	
Flight Test Validation Verification of @AIR Distributed Electric Propulsion Aircraft Dynamic Model	821
<i>Hady Benyamen, Shawn Keshmiri</i>	
Design and Characteristics of a New Transformable UAV with Both Coplanar and Omnidirectional Features	831
<i>Shi Lu, Armando Rodriguez, Konstantinos Tsakalis, Yan Chen</i>	
Designing for Calmness: Early Investigations into Drone Noise Pollution Management	839
<i>Dylan Cawthorne, Peter Moller Juhl</i>	
Dynamic/CFD Modeling, Control and Energy-Consumption Comparative Analysis of a Quad-Tilting Rotor VTOL UAS	849
<i>Tariq Zioud, Juan Escareno, Ouidad Labbani-Igbida</i>	
Aerodynamic Design of Fixed-Wing Mode for a Ducted-fan Tiltrotor UAV by Digital DATCOM.....	859
<i>Jing Huang, Ban Wang, Yangping Deng, Kaikai Ning, Youmin Zhang</i>	
Dynamic Feedback Linearization of a UAV Suspended Load System	865
<i>Arash Mohammadhasani, Mohamed Al Lawati, Zifei Jiang, Alan F. Lynch</i>	
Near Minimum Time Trajectory Planning for Surveying Using UAVs.....	873
<i>Srinath Tankasala, Can Pehlivanurk, Mitch Pryor</i>	
Genetic Algorithm for Path Planning of UAVs as a Maze-Solving Problem.....	881
<i>M. A. Gutierrez-Martinez, L. E. Cabrales-Ramirez, E. U. Rojo-Rodriguez, E. J. Ollervides-Vazquez, P. Castillo, O. Garcia-Salazar</i>	
Spiral Trajectories for Building Inspection with Quadrotors	891
<i>Juan Irving Vasquez-Gomez, David E. Troncoso Romero, Mayra Antonio-Cruz, Erik Zamora</i>	
Dynamic and Distributed Optimization for the Allocation of Aerial Swarm Vehicles	897
<i>Jason Hughes, Dominic Larkin, Charles O'Donnell, Christopher Korpela</i>	
Efficient and Adaptable Task Assignment for UAS Considering the MDMTSP.....	903
<i>Nicholas Degroote, Justin N. Ouwerkerk, Anthony P. Lamping, Kelly Cohen</i>	
Observability Based Path Planning for Multi-Agent Systems to Aid Relative Pose Estimation.....	912
<i>Rohith Boyinine, Rajnikant Sharma, Kevin Brink</i>	
A Review of the Operational Use of UAS in Public Safety Emergency Incidents.....	922
<i>Hunter M. Ray, Ryan Singer, Nisar Ahmed</i>	
An Early Forest Fire Detection System Based on DJI M300 Drone and H20T Camera.....	932
<i>Shun Li, Linhan Qiao, Youmin Zhang, Jun Yan</i>	

UAV-Based LiDAR Mapping with Galileo-GPS PPP Processing and Cooperative Navigation	938
<i>Flavia Causa, Marcello Ascioffa, Roberto Opromolla, Pere Molina, Alberto Mennella, Marco Nisi, Giancarmine Fasano</i>	
Recovering the 3D UUV Position Using UAV Imagery in Shallow-Water Environments.....	948
<i>Antun Đuras, Matija Sukno, Ivana Palunko</i>	
Dynamic Coded Distributed Convolution for UAV-Based Networked Airborne Computing	955
<i>Bingnan Zhou, Junfei Xie, Baoqian Wang</i>	
Autonomous Reactive LiDAR-Based Mapping for Powerline Inspection	962
<i>J. Paneque, V. Valseca, J. R. Martinez-De Dios, A. Ollero</i>	
Target Capturing in an Ellipsoidal Region with a Swarm of Quadrotor UAVs	972
<i>M. Alp Merzi, Veysel Gazi, Giuseppe Fedele, Luigi D'Alfonso, Antonio Bono</i>	
Autonomous Area Search Using Market-Based Assignment in Multi-Vehicle Unmanned Aerial Systems.....	982
<i>Matthew S. Hopchak, Duane T. Davis, Kathleen B. Giles, Kevin D. Jones, Marianna J. Jones</i>	
SwarmHawk: Self-Sustaining Multi-Agent System for Landing on a Moving Platform Through an Agent Supervision	990
<i>Ayush Gupta, Ekaterina Dorzhieva, Ahmed Baza, Mert Alper, Aleksey Fedoseev, Dzmitry Tsetselukou</i>	
Decentralized Moving Horizon Estimation for a Fleet of UAVs	998
<i>Egidio D'Amato, Immacolata Notaro, Barbara Iodice, Giulia Panico, Luciano Blasi</i>	
Task Allocation and Path Planning for Collaborative Swarm Guidance in Support of Artillery Mission	1006
<i>N. Pinon, G. Strub, S. Changey, M. Basset</i>	
Cooperative Multi-UAV System for Surveillance and Search&Rescue Operations Over a Mobile 5G Node	1016
<i>R. Zahinos, H. Abaunza, J. I. Murillo, M. A. Trujillo, A. Viguria</i>	
Sound Noise Properties of Variable Pitch Propeller for Small UAV	1025
<i>Maciej Podsedkowski, Rafal Konopinski, Michal Lipian</i>	
Characterisation of Unmanned Aerial Vehicle Performance Under Extreme Environmental Conditions in a Controlled Atmospheric Facility	1030
<i>A. Bojeri, E. Mai, G. Ristorto, R. Parin, A. Vilardi, G. Guglieri</i>	
Metaheuristic Optimization-Based Fault-tolerant Formation Control of Multiple UAVs.....	1040
<i>Majd Saied, Farah Rasheed, Clovis Francis</i>	
A Flexible Propelled Arm: Mechanical Considerations for the Use in UAVs	1047
<i>F. Ruiz, B. Arrue, A. Ollero</i>	
Drone as a Target of Terrorist Attack and a Weapon Against Terrorism – Analysis in the Light of International Law	1056
<i>Mateusz Osiecki, Agnieszka Fortonska, Matylda Berus, Marta Włodarczyk</i>	
Machine Learning with Echo State Networks for Automated Fault Diagnosis in Small Unmanned Aircraft Systems	1066
<i>Emil Lykke Diget, Agus Hasan, Poramate Manoonpong</i>	

Air Risk Maps for Unmanned Aircraft in Urban Environments.....	1073
<i>Matteo Milano, Stefano Primatesta, Giorgio Guglieri</i>	
Preliminary Ground Risk Tiering for Small Unmanned Aerial Vehicles (sUAV) in Metropolitan Environments.....	1083
<i>Anush Kumar Sivakumar, Mohd Hasrizam Che Man, Kin Huat Low</i>	
Supporting Drone Mission Planning and Risk Assessment with Interactive Representations of Operational Parameters	1091
<i>Balita Rakotonarivo, Nicolas Drougard, Stephane Conversy, Jeremie Garcia</i>	
An Analysis of Machine Learning Classifiers for Joint Operator-UAV Monitoring and Abnormal Command Detection.....	1101
<i>Rafaella Elia, Antonis Savva, Eva Petteimeridou, Theocharis Theocharides</i>	
Detection of Stealthy Adversaries for Networked Unmanned Aerial Vehicles.....	1111
<i>Mohammad Bahrani, Hamidreza Jafarnejadsani</i>	
UAV-Based Receding Horizon Control for 3D Inspection Planning	1121
<i>Savvas Papaioannou, Panayiotis Kolios, Theocharis Theocharides, Christos G. Panayiotou, Marios M. Polycarpou</i>	
An Integrated UAV System for Wildfire Evolution Monitoring and Data Acquisition	1131
<i>Constantinos Heracleous, Panayiotis Kolios, Christos G. Panayiotou</i>	
Predictive Optimal Collision Avoidance for a Swarm of Fixed-Wing Aircraft in 3D Space.....	1139
<i>Ishaan Khare, Harikumar Kandath, K. Madhava Krishna</i>	
Barrier Lyapunov-Based Nonlinear Trajectory Following for Unmanned Aerial Vehicles with Constrained Motion.....	1146
<i>Saurabh Kumar, Shashi Ranjan Kumar</i>	
Fast Search Method for Moving Targets Using Multiple UAVs Cooperative Searching.....	1156
<i>Weiyong Tian, Li Liu, Qiusheng Wang</i>	
Finite-Time Convergent Robust Trajectory Tracking for Unmanned Aerial Vehicles	1166
<i>Saurabh Kumar, Shashi Ranjan Kumar</i>	
Risk-Aware Guidance of a Fixed-Wing UAV Using Neural Network Model Predictive Control.....	1176
<i>Paul Berard, Sylvain Bertrand, Baptiste Levasseur</i>	
Feedforward Control for Wind Rejection in Fixed-Wing UAVs	1185
<i>Jackson Empey, Meyer Nahon</i>	
On the Problem of UAV Collision Avoidance Based on Adaptive Load Factor Control	1194
<i>Tagir Muslimov</i>	
Nonlinear MPC for Multiple Quadrotors in Dynamic Environments.....	1201
<i>Luis F. Recalde, Bryan S. Guevara, Victor Andaluz, Jose Varela, Javier Gimenez, Daniel Gandolfo</i>	
An Intelligent BMS for Drone-Based Inspection of Offshore Wind Turbines	1210
<i>Denggao Huang, Victor Becerra, Hongjie Ma, Sarinova Simandjuntak, Alexander Fraess-Ehrfeld</i>	
The Co4AIR Marathon – a Matlab Simulated Drone Racing Competition.....	1219
<i>Marius Dragomir, Vicu-Mihalis Maer, Lucian Busoni</i>	

Development of Resilient Drones for Harsh Arctic Environment: Challenges, Opportunities, and Enabling Technologies	1227
<i>Agus Hasan, Vadim Kramar, Jussi Hermansen, Ulrik Pagh Schultz</i>	
Concept for a U-Space Compliant UAS-Flight Authorization Service: The Flight Authorization and Activation Process.....	1237
<i>Tobias Grebner, Alexander Fay</i>	
MPSoC4Drones: An Open Framework for ROS2, PX4, and FPGA Integration	1246
<i>Frederik Falk Nyboe, Nicolaj Haarhoj Malle, Emad Ebeid</i>	
A 55-Pound Vertical-Takeoff-and-Landing Fixed-Wing sUAS for Science: Systems, Payload, Safety Authorization, and High-Altitude Flight Performance	1256
<i>Calvin Coopmans, Stockton Slack, Daniel J. Robinson, Nathan Schwemmer</i>	
MRS Modular UAV Hardware Platforms for Supporting Research in Real-World Outdoor and Indoor Environments	1264
<i>Daniel Hert, Tomas Baca, Pavel Petracek, Vit Kratky, Vojtech Spurny, Matej Petrlik, Matous Vrba, David Zaitlik, Pavel Stoudek, Viktor Walter, Petr Stepan, Jiri Horyna, Vaclav Pritzl, Giuseppe Silano, Daniel Bonilla Licea, Petr Stibinger, Robert Penicka, Tiago Nascimento, Martin Saska</i>	
Aerial Coverage Analysis for Mobile Network Operator: A Comparison Model of Simulation and UAV Based Measurement in the Different Altitudes	1274
<i>Ediz Nazmi Orhan, Atakan Yilmaz, Gökhan Kalem, Mehmet Akif Durmaz</i>	
A Comparison of Command and Control Communication Protocols for Unmanned Aircraft: STANAG 4586 Vs. MAVLink.....	1283
<i>Lorenz Reichstein, Simon Schopferer, Franz Junger</i>	
Performance Evaluations for Opportunistic Data Acquisitions from Sparse and Drifting Wireless Sensor Networks with a UAV	1293
<i>Tu Dac Ho</i>	
UVDAR-COM: UV-Based Relative Localization of UAVs with Integrated Optical Communication.....	1302
<i>Jiri Horyna, Viktor Walter, Martin Saska</i>	
Adaptive Frequency Band Selection for Accurate and Fast Positioning Utilizing SOPs	1309
<i>Nicolas Souli, Panayiotis Kolios, Georgios Ellinas</i>	
Wi-Fi Based Telecommunication Infrastructure Delivered as a Service by UAV for Emergency Response.....	1316
<i>Artur Zolich, David Palma, Roger Birkeland, Krzysztof Cisek, Tor Arne Johansen</i>	
Autonomous Flight Control of a Low-Altitude, Long-Range Solar Powered UAV	1324
<i>Doyoung Kim, Taelim Kim, Jehoon Lee, Sanghyuk Park</i>	
A Map Building and Sharing Framework for Multiple UAV Systems	1333
<i>Antonio Silva, Maik Basso, Paulo Mendes, Denis Rosario, Eduardo Cerqueira, Bruno J. G. Praciano, Joao Paulo J. Da Costa, Edison Pignaton De Freitas</i>	
Autonomous Robust Navigation System for MAV Based on Monocular Cameras	1343
<i>Kenny A. Q. Caldas, Joao R. S. Benevides, Roberto S. Inoue, Marco H. Terra</i>	
Fire Monitoring with a Fixed-Wing Unmanned Aerial Vehicle.....	1350
<i>Fares El Tin, Inna Sharf, Meyer Nahon</i>	

Three-Dimensional Waypoint Navigation of Multicopters by Attitude and Throttle Commands Using Off-Policy Reinforcement Learning	1359
<i>Francesco D'Apolito, Christoph Sulzbachner</i>	
Multi-Sensor System for Pipe Inspection Using an Autonomous Hybrid Aerial Robot	1367
<i>Marco A. Montes-Grova, Francisco J. Perez-Grau, Antidio Viguria</i>	
Adaptive Control of Coupled-Multicopter Systems	1375
<i>Dimitris Chaikalas, Nikolaos Evangeliou, Anthony Tzes, Farshad Khorrami</i>	
Probabilistic Traffic Density Estimation Using Measurements from Unmanned Aerial Vehicles.....	1381
<i>Y. Englezou, S. Timotheou, C. G. Panayiotou</i>	
Non-Contact Bridge Deck Evaluation Using Infrared Thermography, a Pipeline for Data Annotation.....	1389
<i>Boshra Besharatian, Sattar Dorafshan</i>	
Learning-Based NMPC Framework for Car Racing Cinematography Using Fixed-Wing UAV.....	1397
<i>Dev Soni, Amith Manoharan, Prakrit Tyagi, P. B. Sujit</i>	
Energy Optimal 3D Target Tracking Using Fixed-Wing UAV.....	1404
<i>Prakrit Tyagi, Cunjia Liu, P. B. Sujit</i>	
Unmanned Aerial Vehicles (UAVs): Persistent Surveillance for a Military Scenario	1411
<i>Andy Ham, Delchynne Similien, Stanley Baek, George York</i>	
System-Of-Systems for Remote Situational Awareness: Integrating Unattended Ground Sensor Systems with Autonomous Unmanned Aerial System and Android Team Awareness Kit.....	1418
<i>Jinho Kim, Tim Gregory, Jade Freeman, Christopher M. Korpela</i>	
Wind Tunnel & Flight Test of VCCS Morphing UAV	1424
<i>Jaebaek Jeong, Jae-Sung Bae</i>	
Extended State Observer-Based Finite-Time Trajectory Tracking Control of Fixed-Wing UAV with Prescribed Error Constraint	1432
<i>Yiwei Xu, Ziquan Yu, Fuyang Chen, Youmin Zhang</i>	
Progress and Challenges with the Implementation of European Drone Regulation - Status Quo and Outlook.....	1438
<i>Christian Janke, Maarten Uijt De Haag</i>	
An SDR-Based LTE System for Unmanned Aerial Systems	1448
<i>Jinran Zhang, Baoqian Wang, Dong Wang, Shengli Fu, Kejie Lu, Yan Wan, Junfei Xie</i>	
Experimental Verification of an LiDAR Based Gust Rejection System for a Quadrotor UAV	1455
<i>Arthur P. Mendez, James F. Whidborne, Lejun Chen</i>	
Experiments on Collaborative Transport of Cable-Suspended Payload with Quadrotor UAVs	1465
<i>Eitan Bulka, Chang He, Jad Wehbeh, Inna Sharf</i>	
Two Planes Balancing Method of UAV Motors Using a Single Three-Axis MEMS Accelerometer	1474
<i>Rafal Konopinski, Leszek Podsedkowski</i>	
UAV Platforms for Autonomous Navigation in GPS-Denied Environments for Search and Rescue Missions	1481
<i>Ethan Ngo, Jaime Ramirez, Manuel Medina-Soto, Shane Dirksen, Ethan Dominic Victoriano, Subodh Bhandari</i>	

Preliminary Design Optimisation of a Novel Fixed-Tilt Heterogeneous UAV for Horizontal Agility	1489
<i>Salim Al-Zubaidi, Karl A. Stol</i>	
Fully Actuated Hexa-Rotor UAV: Design, Construction, and Control. Simulation and Experimental Validation	1497
<i>Alejandro Flores, Gerardo Flores</i>	
Low Altitude Control of the VTOL UAV Tolerant to Ground Effect and Actuator Failures.	1504
<i>J. C. Gonzalez-Guerrero, J. Diaz-Tellez, J. Estevez-Carreon, R. Mendoza-Vazquez, M. A. Meraz-Melo, J. F. Guerrero-Castellanos</i>	
Practical Consensus-Based Formation Control for Quadrotor Systems	1510
<i>Andreas Steinleitner, Robert Ballam, Aaron McFadyen</i>	
Deep Learning Model-Agnostic Controller for VTOL Class UAS	1520
<i>Grant Holmes, Mozammal Chowdhury, Aaron McKinnis, Shawn Keshmiri</i>	
Toward Modular Aerial Robotic System for Applications in Precision Agriculture.....	1530
<i>D. Kotarski, P. Piljek, M. Pranjic, J. Kasac</i>	
Dynamic and Directionally Scaled Geocages for Containment of UAS Operations.....	1538
<i>Sonja Hauber, Markus Ortlieb, Pranav Nagarajan</i>	
Aerobatics on Three-Dimensional Paths for Agile Fixed-Wing Unmanned Aerial Vehicles	1547
<i>Juan Carlos Hernandez Ramirez, Meyer Nahon</i>	
Sliding Mode Control of a Vision Augmented 3 DoF Quadrotor with Input and State Constraints	1555
<i>Archit Krishna Kamath, Subhash Chand Yogi, Padmini Singh, Laxmidhar Behera, Saeid Nahavandi</i>	
Soft Actor-Critic with Inhibitory Networks for Retraining UAV Controllers Faster	1561
<i>Minkyu Choi, Max Filter, Kevin Alcedo, Thayne T. Walker, David Rosenbluth, Jaime S. Ide</i>	
Tangent-Based Method for Collision Detection and Avoidance System for UAVs Using ADS-B Transponder and ADS-B Like Solution	1571
<i>Stanley Ossyra, Zhijun Chen, Rebecca J. Lee, Aziz Ahmad, Richard Pham, Kaelyn Fenstermacher, Subodh Bhandari</i>	
Autonomous Obstacle Avoidance for UAV Based on Point Cloud	1580
<i>Na Shen, Jiale Cao, Matthias Zipp, Wilhelm Stork</i>	
Tree-Level Irrigation Inference Using UAV Thermal Imagery and Convolutional Neural Networks.....	1586
<i>Haoyu Niu, Dong Wang, Yangquan Chen</i>	
Implementation and Performance Evaluation of a Consensus Protocol for Multi-UAV Formation with Communication Delay.....	1592
<i>Fausto Francesco Lizzio, Elisa Capello, Giorgio Guglieri</i>	
Development of an Aerial Drone System for Water Analysis and Sampling.....	1601
<i>Kazi Ragib Ishraq Sanim, Michail Kalaitzakis, Bhanuprakash Kosaraju, Zechariah Kitzhaber, Caitlyn English, Nikolaos Vitzilaios, Michael Myrick, Michael Hodgson, Tammi Richardson</i>	
A Field Study of Soil Biochar Treatment Response Using Small Unmanned Aerial Systems (sUAS)	1608
<i>Di An, Derek Hollenbeck, Si Gao, Yangquan Chen</i>	

Tree-Level Yield Estimation Using UAV-based Vegetation Indices and Plant Physiology-informed Machine Learning.....	1614
<i>Haoyu Niu, Dong Wang, Reza Ehsani, Yangquan Chen</i>	
A Modified Near-Field Gaussian Plume Inversion Method Using Multi-sUAS for Emission Quantification.....	1620
<i>Derek Hollenbeck, Demetrius Zulevic, Yangquan Chen</i>	
Bio-Inspired Control for Collective Motion in Swarms of Drones	1626
<i>Matthieu Verducq, Guy Theraulaz, Ramon Escobedo, Clement Sire, Gautier Hattenberger</i>	
A Laguerre-Based Distributed Nonlinear Model Predictive Control Scheme for Dynamic Obstacle Avoidance on Multi-Rotor UAVs	1632
<i>Oscar J. Gonzalez V, Antonio Tsourdos</i>	
Automatic Detection of Rescue Targets in Maritime Search and Rescue Missions Using UAVs	1638
<i>Luis Gonalves, Bruno Damas</i>	
Mission Planning and Execution in Heterogeneous Teams of Aerial Robots Supporting Power Line Inspection Operations.....	1644
<i>Alvaro Calvo, Giuseppe Silano, Jesus Capitan</i>	
Current Status and Flight Demonstration of UTM in Korea	1650
<i>Kyusur Jung, Songju Kim, Beechuila Jung, Seyeon Kim, Jieun Jang, Changbong Kang</i>	
First Steps Toward Certifying an UAS to Receive Fuel Airborne	1656
<i>Benjamin L. Ross, Caleb A. Mauldin, Jonathon K. Parry, Donald H. Costello</i>	
Low-Cost Drone for Confined Space Inspection.....	1662
<i>A. Fernandez, H. Gonzalez-Jorge, L. M. Gonzalez-Desantos, E. Aldao</i>	
A Perception-Aware NMPC for Vision-Based Target Tracking and Collision Avoidance with a Multi-Rotor UAV	1668
<i>Andriy Dmytruk, Giuseppe Silano, Davide Bicego, Daniel Bonilla Licea, Martin Saska</i>	

Author Index