PROCEEDINGS OF SPIE

Space Exploration Technologies II

Wolfgang Fink *Editor*

13 April 2009 Orlando, Florida, United States

Sponsored and Published by SPIE

Volume 7331

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in Space Exploration Technologies II, edited by Wolfgang Fink, Proceedings of SPIE Vol. 7331 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X ISBN 9780819475978

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445 SPIE.org

Copyright © 2009, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/09/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

v Conference Committee

SESSION 1	AUTONOMOUS AERIAL/SPACE OPERATIONS AND CONTROL				
7331 05	Autonomous self-configuration of artificial neural networks for data classification or system control [7331-04] W. Fink, California Institute of Technology (United States)				
7331 06	BEARS: a multi-mission anomaly response system (Invited Paper) [7331-05] B. A. Roberts, Space Sciences Lab. (United States)				
SESSION 2	MODELS AND ALGORITHMS FOR SPACE OPERATIONS				
7331 09	Parameter extraction for flexible photovoltaic (FPV) modules to determine high insolation performance for space solar applications [7331-09] P. Sharma, S. P. Duttagupta, V. Agarwal, Indian Institute of Technology, Bombay (India)				
SESSION 3	AMERICAN AND CHINESE SPACE ROBOTICS				
7331 OB	Multi-rover testbed for teleconducted and autonomous surveillance, reconnaissance, and exploration [7331-11] W. Fink, M. A. Tarbell, California Institute of Technology (United States)				
7331 OC	The dynamic analysis and control strategy of spherical robot with telescopic manipulator [7331-12] H. Sun, Y. Zheng, Q. Jia, C. Shi, Beijing Univ. of Posts and Telecommunications (China)				
7331 0D	Research on modeling and motion simulation of a spherical space robot with telescopic manipulator based on virtual prototype technology [7331-13] C. Shi, H. Sun, Q. Jia, K. Zhao, Beijing Univ. of Posts and Telecommunications (China)				
7331 OE	The hydrodynamics analysis for the underwater robot with a spherical hull [7331-14] X. Lan, H. Sun, Q. Jia, Beijing Univ. of Posts and Telecommunications (China)				
SESSION 4	SUPPORT TECHNOLOGIES FOR SPACE MISSIONS				
7331 OH	3D imaging lidar for lunar robotic exploration [7331-17] M. W. Hussein, J. W. Tripp, Optech, Inc. (Canada)				
7331 01	Emissivity modulating electrochromic device [7331-18] H. Demiryont, K. C. Shannon III, J. Sheets, Eclipse Energy Systems, Inc. (United States)				

7331 0K Piezomechatronic-based systems in aircraft, space, and defense applications [7331-20] T. Maillard, F. Claeyssen, R. LeLetty, O. Sosnicki, A. Pages, CEDRAT Technologies (France); A. Vazquez Carazo, Micromechatronics, Inc. (United States)

Author Index

Conference Committee

Symposium Chair

Ray O. Johnson, Lockheed Martin Corporation (United States)

Symposium Cochair

Michael T. Eismann, Air Force Research Laboratory (United States)

Conference Chair

Wolfgang Fink, California Institute of Technology (United States)

Program Committee

Danilo F. Bassi, Universidad de Santiago de Chile (Chile) **Manfred G. Bester**, University of California, Berkeley (United States)

Session Chairs

- Autonomous Aerial/Space Operations and Control Manfred G. Bester, University of California, Berkeley (United States) Wolfgang Fink, California Institute of Technology (United States)
- 2 Models and Algorithms for Space Operations Manfred G. Bester, University of California, Berkeley (United States) Wolfgang Fink, California Institute of Technology (United States)
- 3 American and Chinese Space Robotics
 Manfred G. Bester, University of California, Berkeley (United States)
 Wolfgang Fink, California Institute of Technology (United States)
- Support Technologies for Space Missions
 Manfred G. Bester, University of California, Berkeley (United States)
 Wolfgang Fink, California Institute of Technology (United States)