International
Micro Air Vehicle Conference and Flight Competition

IMAV 2012

Braunschweig, Germany

03 - 06 July 2012

Programme

organised by

German Institute of Navigation

in cooperation with

Deutscher Aero Club

Deutsche Gesellschaft für Luft- und Raumfahrt - Lilienthal-Oberth

supported by

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Introduction

Micro Air Vehicles (MAV) are the smallest man-made flying machines. They are flying robots and have the weight and size of small birds. Innovation in navigation, control and processing technology has made this possible.
There are still numerous scientific challenges to be solved in order to fly Micro Air Vehicles under all flight and weather conditions. The development of miniaturized structures, propulsion and navigation systems, aerodynamics, flight controllers, actuators and sensors are just a few of the current research topics in the field of MAV.
Besides the theoretical part - as before - IMAV 2012 includes an indoor and outdoor flight competition of MAV and will be held at Braunschweig, Germany from 03 - 06 July 2012.
The conference shall serve as a platform to exchange information on the state-of-the-art of MAV. Thus, the German Institute of Navigation cordially invites everyone from Science, Industry, Military, Government Agencies and Users to participate in this conference.

Further information about IMAV 2012 as well as rules and regulations of the flight competition can be found on **www.imav2012.org** .

Tuesday, 03 July 2012

08:00 **Conference Registration**

09:00 **Conference Opening**
Prof. Dr.-Ing.Peter Vörsmann

09:15 **Opening Presentation**
Wake Reconstruction of Flapping-Wing MAV 'DelFly II' in Forward Flight
Mustafa Percin, H.E. Eisma, B.W. van Oudheusden, B. Remes , R. Ruijsink , C. de Wagter, Delft University of Technology, The Netherlands

Session 1: Guidance, Navigation and Control

09:40 **MAV Autopilot for Commercial and Research Purposes**
Kirill Shilov, Grigory Lazurin, Department of Aeromechanics and Flight Engineering, Moscow Institute of Physics and Technology, Russia

10:05 **The Optimum Location of Pressure Taps over a Wing for Dynamic Control Inputs**
Sridhar Ravi, University Tuebingen, Germany, Matthew Marino, Simon Watkins, Jon Watmuff, Phred Petersen, RMIT, Melbourne, Australia

10:30 **Vision-Based Target Detection and Autonomous Target Approach Control for Unmanned MAVs**
Manuel Popp, Justus Seibold, Philipp Crocoll, Natalie Frietsch, Gert F. Trommer, KIT Karlsruhe, Germany

10:55 **Coffee**

11:25 **An Integrated Vision Aided GPS/INS Navigation System for ultra-low-cost MAVs**
Felix Gathmann, Christian Dernehl, Dominik Franke, Stefan Kowalewski, RWTH Aachen University, Germany

11:50 **A Ducted Fan MAV Anti-torque Control System**
Moaad Yacoubi, Frank Buysschaert, Patrick Hendrick, Université Libre de Bruxelles, Belgium

12:15 **Fault-tolerant Control Allocation for Multirotor Helicopters using Parametric Programming**
Thomas Schneider, Autonomous System Lab., ETH Zurich, Switzerland, Guillaume Ducard, University Nice Sophia Antipolis, France

12:40 **Lunch**

13:45 Moving towards a UAV Flight with a Dynamic Inversion Controller and a Navigation Filter
Karl Kufieta, Technische Universität Braunschweig, Germany

14:10 Integrated Control of Quadrotor Flight Dynamics with Complementary Compensator of System Uncertainties
Aleksandar Rodić, Ivan Stojković, University of Belgrade, Serbia

14:35 Coffee

Session 2: Sensors

15:05 Novel Marker Based Tracking Method for Position and Attitude Control of MAVs
Andreas Masselli, A. Zell, University Tuebingen, Germany

15:30 Visual Identification and Tracking for Vertical and Horizontal Targets in the IMAV Competition
Fu Changhong, Pascual Campoy, Jesús Pestana-Puerta, José Luis Sánchez López, Ignacio Mellado-Bataller, Universidad Politécnica de Madrid, Spain

15:55 Multi Disciplinary Optimization in Design of MAVs for Videography
Gaurav V. Tendolkar, K. Sudhakar, Hemendra Arya, Engineering Indian Institute of Technology, Powai Mumbai, India

Session 3: Fuselage and Propulsion Systems

16:20 Propulsive Analysis of High Performance Propellers for Multi-Mission MAVs
Sutthichai Kaeosutthi, Adhum Tohwae-a-yee, Chinnapat Thipyopas, Kasetsart University, Thailand

16:45 Electric Propulsion System Optimization for a Specific Mission with Multiple Conditions
Murat Bronz, Jean-Marc Moschetta, ISAE, Gautier Hattenberger, ENAC, France

17:10 End of Session 3

19:00 – 21:00 **Reception at the old Town Hall**
Altstadtmarkt, Braunschweig

Wednesday, 04 July 2012

08:00 – 17:00 **Outdoor Competition at Wilsche Glider Field**
Bus Transfer to be announced

Thursday, 05 July 2012

Session 4: Aerodynamics

09:00 Pitch-plunging flat Wings in Experiments and Numerical Investigations
Thorsten J. Möller, Ralf Wokoeck, Rolf Radespiel, Technische Universität Braunschweig, Germany

09:25 Aerodynamic Performance of Multi-Mission Morphing Wing MAV
Aritad Choicharoon, Kwanchai Chinwicharnam, Chinnapat Thipyopas, Kasetsart University, Thailand

09:50 Aerodynamic Modeling of the Wing-Propeller Interaction for a Tilt-Body Micro Air Vehicle
Maxime Itasse, Jean-Marc Moschetta, Institut Supérieur de l'Aéronautique et de l'Espace, Toulouse, France

10:15 Coffee

10:45 The Vortex Growth on a Wall of Elastic Airfoils and Effect of Relative Angle of Attack
Tomoki Kurinami, Masaki Fuchiwaki, Kazuhiro Tanaka, Kyushu Institute of Technology, Japan

11:10 Numerical and Experimental Analysis of Pitching and Plunging Airfoils in Hover
Hazan Hizli, D. Funda Kurtulus, Middle East Technical University, Ankara, Turkey

11:35 Plasma Flow Control on MAV Flying Wing Models
Berkant Göksel, C. N. Nayeri, R. Bannasch, F. Behrendt, I. Rechenberg, C. O. Paschereit, Technische Universität Berlin, Germany

12:00 Lunch

13.00 – 17:00 **Indoor Competition**
Volkswagenhalle

19:00 – 21:30 **Symposium Dinner**
Volkswagenhalle

Friday, 06 July 2012

Session 5: MAV Operation

09:00 Coactive Design for Human-MAV Team Navigation
Matthew Johnson, Institute for Human and Machine Cognition, Pensacola, FL, USA

09:25 City Topographies and Atmospheric Winds: Possibilities of Extending the Endurance of MAVs
Simon Watkins, Kevin Massey, Ee Wei Lim, Raj. Ladani, K. C. Wong, RMIT University, Melbourne, Australia

09:50 A Visual Guided Quadrotor for IMAV 2012 Indoor Autonomy Competition and Visual Control of a Quadrotor for the IMAV 2012 Indoor Dynamics Competition
Jose Luis Sanchez Lopez, Ignacio Mellado-Bataller, Jesus Pestana-Puerta, Fu Changhong, Pascual Campoy, Universidad Politecnica de Madrid, Spain

10:15 Coffee

Session 6: System Engineering

10:45 Design and Optimisation Applied to a Multifunctional Modular MAV System
Cheng-Ming Kuo, Andreas Leber, Christian Boller, Saarland University, Saarbrücken, Germany

11:10 Direct Experimental Comparison of Flapping Wing and Fixed Wing Efficiency
Nikita A. Pushchin, Sergey V. Serokhvostov, Moscow Institute of Physics and Technology, Russia

11:35 Lunch

12:45 Measuring and Analyzing the Birds Flight
Alexander Friedl, Christian J. Kähler, Universität der Bundeswehr, Munich, Germany

13:10 State of Progress of the Gun Launched Micro Air Vehicle
Emmanuel Roussel, Patrick Gnemmi, Sebastien Changey et al., French-German Research Institut of Saint-Louis, France

13:35 Coffee

14:05 **Bio-Inspired Design of Micro Ornithopters with Emphasis on Locust Hindwings**
Ryan Randall, Rajeev Kumar, Sergey Shkarayev, University of Arizona, Tucson, USA

14:30 **Studies of Flight Kinematics of Ornithopters**
Garrett Lim, Sergey Shkarayev, University of Arizona, Tucson, USA,
Zachary Goff, Philip Beran, Wright Patterson AFB, Dayton, USA

14:55 **Final discussion and closing remarks**
Prof. Dr.-Ing. Peter Vörsmann

15:15 **End of IMAV 2012**

Poster Presentations

Tuesday, 03 July 2012

- **Numerical Investigation of Flexible Flapping Wing Propulsion at Low-Reynolds Numbers**
  Shuanghou Deng, Wee-Beng Tay, B.W.Oudeheusden, Hester Bijl, Technology University of Delft, The Netherlands, Tianhang Xiao, Nanjing University of Aeronautics and Astronautics, PR China
- **Flight Simulation and Control of a Tailless Flapping Wing MAV near Hover**
  Matěj Karásek, André Preumont, Université Libre de Bruxelles, Belgium
- **Validation and Numerical Simulation Using the Immersed Boundary Method Solvers for Flapping Wing Flight**
  Wee-Beng Tay, Delft University of Technology, The Netherlands
- **Vortex Structure around Moving Elastic Bodies by Fluid Structure Interaction Simulation**
  Tetsushi Nagata, Kyushu Institute of Technology, Japan
- **Towards an Open-Source ROS-Compliant AVR Software Autopilot Platform**
  Marcin Kmiecik, Krzysztof Sibilski, Wroclaw University of Technology, Poland
- **Neural Model of Unsteady Aerodynamic Coefficients of MAV from Water Tunnel Test Data**
  Michal Garbowski, Krzysztof Sibilski, Wroclaw University of Technology, Poland
- **FSR UAV Robotics Team**
  Mohammad Nikkhah, Iman Shirdareh, Ramin Marhamati, Mohsen Afshari, Alireza Riyazi, Islamic Azad University, Fars, Iran
- **Design and Wind Tunnel Testing of an Active Morphing Wing Ornithopter**
  Wenbo *Duan, Haisong Ang, Nanjing University of Aeronautics and Astronautics, P.R. China*
- **Micro Unmanned Vehicle as a Means for Non-Destructive Building Inspection**
  Cheng-Ming Kuo, C.-H. Kuo, Christian Boller, Saarland University, C.Eschmann, Fraunhofer Institute for NDT (IZFP), Germany

Friday, 06 July 2012

- **Numerical Investigation of Azarakhsh MAV**
  Mohammadreza Radmanesh, Mostafa Hassanalian, Sayed Amin Feghhi, Mahdi Niliahmadabadi, Isfahan University of Technology, Iran
- **A new Method for Design of Fixed Wing Micro Air Vehicle**
  Mostafa Hassanalian, Mahmud Ashrafizaadeh, Saeed Ziaei-Rad, Mohammadreza Radmanesh, Isfahan University of Technology, Iran
- **Sending Instructions and Receiving the Data from MAVs using Telecommunication Networks**
  Mostafa Hassanalian, Mohammadreza Radmanesh, Saeed Ziaei-Rad, Isfahan University of Technology, Iran
- **Computational Simulations of 3D Flapping Corrugated Wing for MAV Motivation**
  Ezzeddin M. Elarbi, Tripoli University, Libya
- **Experimental Investigation on Aerodynamics Loads of an Entomopter in Forward Flight – Water Tunnel Tests**
  Pawel Czekalowski, Krzysztof Sibilski, Wroclaw University of Technology, Poland
- **The Influence of Wing Design and Flapping Frequency on the four-dimensional Flow Pattern of a Model Wing at Bird Scale**
  William Thielicke, Eize J. Stammhuis, University of Groningen, The Netherlands, Antonia B. Kesel, University of Applied Sciences Bremen, Germany
- **Design and Test of an Autonomous Tiltwing MAV**
  Ingo Martin, Torben Klougt, Niklas Schreiber, W. Rottner, Dieter Moormann, RWTH Aachen University, Germany
- **Onboard Flight Parameters Registration System**
  Vitaly Kobtsev, Sergey Levin, Sergey Serokhvostov, Nikita Ageev, Moscow Institute of Physics and Technology, Russia

Flight Competition

In addition to the scientific conference program, the IMAV 2012 also comprises a competition for Micro Aerial Vehicles (MAV). This competition is divided into two parts: An indoor competition in Braunschweig and an outdoor competition at the glider field at Gifhorn-Wilsche, approx. 30 km north of Braunschweig.

Both, the indoor and the outdoor event, consist of two different competitions. The first one is focused on flight dynamics and maneuverability, while the second one emphasizes more the autonomous flight. Rules and regulations may be downloaded from this website.
The Team size shall not exceed 5 persons.

Team Captains are asked to complete the Team/ MAV questionnaire on the IMAV 2012 website.

General Information

Venue

Volkswagen Halle
Europaplatz 1
38100 Braunschweig

Conference Office

The Conference Office will be open as follows:

Tuesday,	03 July 2012	08:00 - 18:00 hrs
Thursday,	05 July 2012	08:30 - 12:00 hrs
Friday,	06 July 2012	08:30 - 14:30 hrs

Phone (during the conference) : +49 1520 1956 749

Conference Language

English

Registration

All delegates (**everybody**) including authors, chairpersons, exhibitors and competitors are requested to complete the published **Registration Form on the website** as soon as possible.

Fees

Conference and Flight Competition

Authors; Flight Demonstrators; Chairpersons:	540 €
Members of DGON	640 €
Non-Members	840 €
Retired members of DGON	250 €
Students	150 €

(up to master student and not older than 28, proof required)

The fee includes participation in the conference/ flight competition, documentation, soft drinks and coffee during the breaks, lunch and participation in the "Symposium Dinner" and "Reception" at the Braunschweig Town Hall.

Technical Exhibition

Members of DGON	900 €
Others	1.200 €

The fee covers the rental of space for the exhibition for the duration of the conference and the conference fee for one delegate.
Equipment/systems available or in development with respect to the topics of the symposium may be demonstrated and/or displayed during the conference.
Interested companies/organizations who wish to exhibit or demonstrate may request further information from the

German Institute of Navigation
attn.: Conference coordinator "IMAV"
dgon.bonn@t-online.de

Cancellation/Refund Policy

Cancellations must be made in writing. For cancellations received prior to 12 June 2012 the fee will be refunded, deducting 40,00 € handling charge. No refunds will be made for cancellations received after 12 June 2012. The registration may be transferred.

Methods of Payment

All participants are getting an invoice after the registration on the website www.imav2012.org The invoice points out the bank account of DGON.

Payment with credit cards **(Master or VISA)** or cash is possible at the registration desk only.

Symposium Proceedings

Proceedings will be prepared on CD within eight weeks after the conference to allow inclusion of flight competition results. One copy will be mailed to each participant (price is included in the conference fee).
Authors/presenters are therefore requested to provide to the conference coordinator the documentation (full paper) which should be published in the proceedings as soon as possible but not later than at the symposium. Documentation may be submitted by e-mail or CD.

Transportation

Road schematic to Glider Field at Wilsche

Address using GPS:
38503 Gifhorn, Ringelahweg
(leaving Wilsche to the north, follow Ringelahweg for about 1,2 km)



Glider Field Wilsche
52° 31.5' N
10° 27.7' E



Impressum:

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Programme is subject to change.

Conference coordinator: Gerd Gronemann