19th IFAC Symposium on Automatic Control in Aerospace 2013

Wurzburg, Germany
2-6 September 2013

Editors:

Klaus Schilling       Marco Schmidt
Florian Leutert
## MonAT1
### Spacecraft Guidance, Navigation and Control I (Regular Session)

**Chair:** Matko, Drago  
**Co-Chair:** Kronhaus, Igal  
**Univ. of Ljubljana**  
**Wuerzburg Univ.**  

**MonAT1.1**  
**10:45-11:05**  
**Attitude Control and Momentum Management of Inertially Oriented Space Station,** pp. 1-6.  
Zhang, Jun  
YingZi, He  
JinJiang, Zhang  
Beijing Inst. of Control Engineering  

**MonAT1.2**  
**11:05-11:25**  
**Pulse-Width Attitude Control of Large-Scale Information Satellite at Service Modes,** pp. 7-12.  
Somov, Sergey  
Samara State Tech. Univ.  

**MonAT1.3**  
**11:25-11:45**  
Falcoz, Alexandre  
Watt, Mark  
Yu, Michel  
Kron, Aymeric  
Menon, Prathyush P  
Bates, Declan G.  
Ankersen, Finn  
Kron, Aymeric  
Menon, Prathyush P  
Bates, Declan G.  
Ankersen, Finn  
EADS Astrium  
Astrium Satellites  
Univ. of Sherbrooke  
Univ. of Exeter  
European Space Agency  
ESA - ESTEC  

**MonAT1.4**  
**11:45-12:05**  
Leonangeli, Nazareno  
Sabatini, Marco  
Palmerini, Giovanni B.  
Gasbarri, Paolo  
Univ. La Sapienza, DIAEE  
Univ. La Sapienza  
Sapienza Univ. di Roma  
DIMA, Univ. La Sapienza  

**MonAT1.5**  
**12:05-12:25**  
**Modeling, Optimization, Simulation and Animation of Land-Survey Satellite Motion,** pp. 25-30.  
Somov, Sergey  
Butyrin, Sergey  
Somova, Tatyana  
Samara State Tech. Univ.  
Samara State Tech. Univ.  
Samara State Tech. Univ.  

## MonAT2
### Launcher, RLV and ARV Guidance and Control (Regular Session)

**Chair:** Miyazawa, Yoshikazu  
**Co-Chair:** Albert, Michael  
**Kyushu Univ.**  
**Zentrum für Telematik e.V.**  

**MonAT2.1**  
**10:45-11:05**  
**Closed Loop Guidance Algorithm for Solid Propellant Rocket,** pp. 31-36.  
Pietroboim, Hilton Cleber  
Leite Filho, Waldemar C.  
Inst. de Aeronáutica e Espaço  
Space and Aeronautics Inst.  

**MonAT2.2**  
**11:05-11:25**  
Andrievsky, Boris  
Kuznetsov, Nikolay  
Leonov, Gennady  
Seledzhi, Svetlana  
Inst. for Problems of Mechanical Engineering RAS  
Saint-Petersburg State Univ.  
Saint-Petersburg State Univ.  
St.Petersburg State Univ.  

**MonAT2.3**  
**11:25-11:45**  
**Bridging the Gap between Linear and Nonlinear Worst-Case Analysis: An Application Case to the Atmospheric Phase of the VEGA Launcher,** pp. 42-47.  
Marcos, Andres  
Mantini, Valerio  
Deimos Space S.L.  
ELV
Launch Vehicle Attitude Control System Using PD Plus Phase Lag, pp. 48-53.

H-Infinity Control of the VEGA Launch Vehicle First Stage in Presence of Roll, pp. 54-59.

Invited Session on Unmanned Aerial Vehicles I (Invited Session)
Chair: Tsourdos, Antonios Cranfield Univ.
Co-Chair: Kim, Youdan Seoul National Univ.
Organizer: Tsourdos, Antonios Cranfield Univ.
Organizer: Kim, Youdan Seoul National Univ.

Suboptimal Guidance of UAVs Satisfying Multiple Constraints on Waypoints (I), pp. 78-83.

Verification and Validation of a FDD System for Identification of Aircraft Control Surface Jamming, pp. 84-89.
Aircraft Nonlinear AFTC Based on Geometric Approach and Singular Perturbations in Case of Actuator and Sensor Faults, pp. 90-95.
Innovative Fault Detection, Isolation and Recovery - Project Description, pp. 96-100.
15:00-15:20 MonBT2.4
Marcos, Andres
Penin, Luis F.
Malikov, Dimitri
Reichstadt, Sebastien
Le Gonidec, Serge

15:20-15:40 MonBT2.5
Liu, Wenjing
Wang, Dayi
Liu, Chengrui

MonCT1
Invited Session on Unmanned Aerial Vehicles II (Invited Session)

Chair: Tsourdos, Antonios
Co-Chair: Kim, Youdan
Organizer: Tsourdos, Antonios
Organizer: Kim, Youdan

16:15-16:35 MonCT1.1
Differential Geometry Based Collision Avoidance Guidance for Multiple UAVs (I), pp. 113-118.
Seo, Joongbo
Kim, Youdan
Tsourdos, Antonios

16:35-16:55 MonCT1.2
Coordinated Trajectory Planning for Efficient Communication Relay Using Multiple UAVs (I), pp. 119-124.
Oh, Hyondong
Kim, Seungkeun
Suk, Jinyoung
Tsourdos, Antonios

MonCT2
Missile Guidance Navigation and Control (Regular Session)

Chair: Roth, Hubert
Co-Chair: Sun, Kaipeng

16:15-16:35 MonCT2.1
Funnel Flight Controller for a TDR 6-DoF Simulation Model, pp. 125-130.
Hopfe, Norman
Caldas-Pinto, Pedro
Kurth, Guido

16:35-17:15 MonCT2.2
Pharpatare, Pawit
Hérissé, Bruno
Pepy, Romain
Bestaoui, Yasmina

16:55-17:15 MonCT2.3
Lee, Yongwoo
Kim, Youdan
## Technical Program for Tuesday September 3, 2013

### Invited Session on Rendezvous and Docking to Passive Objects in Space (Invited Session)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair</th>
<th>Co-Chair</th>
<th>Organizer</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:45-10:05</td>
<td>TueAT1.1 On-Line Collision Detection for Space Applications Using Photonic Mixer Devices (I), pp. 143-148.</td>
<td>Scharnagl, Julian</td>
<td>Regoli, Leonardo</td>
<td>Schilling, Klaus</td>
<td>Turing Hall</td>
</tr>
<tr>
<td>10:45-11:05</td>
<td>TueAT1.4 On Grasping a Tumbling Debris Object with a Free-Flying Robot (I), pp. 161-166.</td>
<td>Lampariello, Roberto</td>
<td></td>
<td></td>
<td>Turing Hall</td>
</tr>
</tbody>
</table>

### Avionics and On-Board Equipments (Regular Session)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair</th>
<th>Co-Chair</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:40-12:00</td>
<td>TueBT1.2 System Identification of a Spacecraft Antenna Pointing Mechanism, pp. 172-177.</td>
<td>Kornienko, Andrei</td>
<td>Wuseni, Robert</td>
<td>Turing Hall</td>
</tr>
<tr>
<td>12:00-12:20</td>
<td>TueBT1.3 Network-Centric Approach for Modular Avionics, pp. 178-182.</td>
<td>Herpel, Hans-Juergen</td>
<td>Willich, Georg</td>
<td>Turing Hall</td>
</tr>
<tr>
<td>12:20-12:40</td>
<td>TueBT1.4 The Methods of Forecasting Some Events During the Aircraft Takeoff and Landing, pp. 183-187.</td>
<td>Kuznetsov, Alexey</td>
<td>Shevchenko, Andrey</td>
<td>Turing Hall</td>
</tr>
</tbody>
</table>

### Unmanned Aerial Vehicles I (Regular Session)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair</th>
<th>Co-Chair</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30-13:50</td>
<td>TueCT1.1</td>
<td>Fichter, Walter</td>
<td>Heß, Robin</td>
<td>Turing Hall</td>
</tr>
<tr>
<td>Time</td>
<td>Session</td>
<td>Title</td>
<td>Authors</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>14:00-14:20</td>
<td>TueCT1.1</td>
<td>Flight Control of a Powered Paraglider by MIMO PID Control Based on Two-Degree-Of-Freedom Integral-Type Optimal Servomechanism, pp. 188-193.</td>
<td>Ochi, Yoshimasa National Defense Acad,</td>
<td></td>
</tr>
<tr>
<td>14:40-15:00</td>
<td>TueCT1.3</td>
<td>Visual Servoing Based Landing Approach Controller for Fixed-Wing MAVs, pp. 200-205.</td>
<td>Trittler, Martin Univ. of Stuttgart, Rothermel, Thomas iFR, Univ. of Stuttgart, Fichter, Walter Univ. Stuttgart</td>
<td></td>
</tr>
<tr>
<td>15:00-15:20</td>
<td>TueCT1.4</td>
<td>Control of Variable-Pitch Quadrotors, pp. 206-211.</td>
<td>Riccardi, Fabio Pol. di Milano, Haydar, Muhammad Farooq Pol. di Milano, Formentin, Simone Pol. di Milano, Lovera, Marco Pol. di Milano</td>
<td></td>
</tr>
<tr>
<td>TueCT2</td>
<td>Zuse Hall</td>
<td>Micro and Nano-Aerospace Vehicles/satellites and Aerospace Student Projects I (Regular Session)</td>
<td>Chair: Okubo, Hiroshi Oska Prefecture Univ., Co-Chair: Nogueira, Tiago Julius-Maximilians Univ. Würzburg</td>
<td></td>
</tr>
<tr>
<td>14:00-14:20</td>
<td>TueCT2.1</td>
<td>Robust and Efficient OBDH Core Module for the Flexible Picosatellite Bus UWE-3, pp. 218-223.</td>
<td>Busch, Stephan Univ. Wuerzburg, Schilling, Klaus Univ. Wuerzburg</td>
<td></td>
</tr>
<tr>
<td>15:00-15:20</td>
<td>TueCT2.4</td>
<td>Robust Satellite Engineering in Educational Cubesat Missions in the Example of the UWE-3 Project, pp. 236-241.</td>
<td>Busch, Stephan Univ. Wuerzburg, Schilling, Klaus Univ. Wuerzburg, Reichel, Florian Zentrum für Telematik e.V., Bangert, Philip ZT - Zentrum für Telematik e.V.</td>
<td></td>
</tr>
<tr>
<td>15:20-15:40</td>
<td>TueCT2.5</td>
<td>Space Based Automatic Identification and Monitoring System for Large-Scale Railway Transportation - GP-AIMS, pp. 242-247.</td>
<td>Kleinschrodt, Alexander Univ. of Wuerzburg</td>
<td></td>
</tr>
</tbody>
</table>
### TueDT1
#### Unmanned Aerial Vehicles II (Regular Session)

**Chair:** Ochi, Yoshimasa  
**Co-Chair:** Scharnagl, Julian  

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>16:55-17:15</td>
<td>TueDT1.3</td>
<td>Cooperative Guidance of UAVs for Area Exploration with Final Target Allocation, pp. 260-265.</td>
<td>Gorecki, Tomasz, Piet-Lahanier, Helene, Marzat, Julien, Balesdent, Mathieu</td>
</tr>
<tr>
<td>17:15-17:35</td>
<td>TueDT1.4</td>
<td>Control Design of Ultra-Quiet Spacecraft Platform, pp. 266-270.</td>
<td>Tang, Liang, Guan, Xin, Zhang, Duzhou, He, Yingzi</td>
</tr>
</tbody>
</table>

### TueDT2
#### Micro and Nano-Aerospace Vehicles/satellites and Aerospace Student Projects II (Regular Session)

**Chair:** Schmidt, Marco  
**Co-Chair:** Kleinschrodt, Alexander  

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>16:15-16:35</td>
<td>TueDT2.1</td>
<td>The Attitude Determination and Control System of the Picosatellite UWE-3, pp. 271-276.</td>
<td>Reichel, Florian, Bangert, Philip, Busch, Stephan, Ravandoor, Karthik, Schilling, Klaus</td>
</tr>
<tr>
<td>16:35-16:55</td>
<td>TueDT2.2</td>
<td>Pico-Satellite Orbit and Attitude Control by Electric Propulsion, pp. 277-282.</td>
<td>Kronhaus, Igal, Schilling, Klaus</td>
</tr>
<tr>
<td>16:55-17:15</td>
<td>TueDT2.3</td>
<td>SDS-4 Attitude Control System: In-Flight Results of Three Axis Attitude Control for Small Satellites, pp. 283-288.</td>
<td>Nakajima, Yuta, Murakami, Naomi, Ohtani, Takashi, Nakamura, Yosuke, Hirako, Keiichi</td>
</tr>
</tbody>
</table>

Kuwahara, Toshinori
Tomioka, Yoshihiro
Fukuda, Kazufumi
Yoshida, Kazuya
Baeckstroem, Johan
Bruhn, Fredrik

Tohoku Univ.
Tohoku Univ.
Tohoku Univ.
Tohoku Univ.
AAC Microtec AB,
AAC Microtec AB
Technical Program for Wednesday September 4, 2013

WeAT1  
**Invited Session on Missile Guidance Navigation and Control I (Invited Session)**

Chair: Tsourdos, Antonios  
Co-Chair: Le Menec, Stephane  
Organizer: Tsourdos, Antonios  
Organizer: Le Menec, Stephane

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 08:30-08:50 | WeAT1.1  
*Particle Guidance: Applying POMDPs to the Optimization of Mid-Course Guidance Laws for Long-Range Missiles (Code Pm846) (I)*, pp. 295-300.  
Le Menec, Stephane  
Pop-Stefanov, Bruno

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 08:50-09:10 | WeAT1.2  
Piet-Lahanier, Helene  
Kahn, Arthur  
Marzat, Julien

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 09:10-09:30 | WeAT1.3  
Dwivedi, Prasiddha Nath  
Bhale, Prashant Gajanan  
Bhattacharyaa, Abhijit  
Padhi, Radhakant

WeAT2  
**Sensor Data Fusion (Regular Session)**

Co-Chair: Eck, Daniel

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 08:30-08:50 | WeAT2.1  
Nasir, Ahmad Kamal  
Hsino, Aiman  
Roth, Hubert  
Hartmann, Klaus

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 08:50-09:10 | WeAT2.2  
*Information Fusion Levels in Star Sensor Systems*, pp. 319-323.  
Strietzel, Roland  
Michel, Klaus

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 09:10-09:30 | WeAT2.3  
*Range Extension of the PMD Sensor with Regard to Applications in Space*, pp. 324-329.  
Tzschichholz, Tristan  
Schilling, Klaus

WeBT1  
**Invited Session on Missile Guidance Navigation and Control II (Invited Session)**

Chair: Tsourdos, Antonios  
Co-Chair: Le Menec, Stephane  
Organizer: Tsourdos, Antonios  
Organizer: Le Menec, Stephane

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 10:00-10:20 | WeBT1.1  
*Adaptive Sliding Mode Autopilot Design for Skid-To-Turn Missile Model with Uncertainties (I)*, pp. 330-335.  
Ra, Chunggil  
Kim, Seungkeun  
Suk, Jinyoung  
Kim, Youdan  
Moon, Gwanyoung  
Jun, Byung-Eul
## WeBT1.2

**Optimal Midcourse Guidance Law with Flight Path Angle and Lead Angle Constraints to Reach Circular Target Area (I), pp. 336-340.**

- **Jeon, Byoung-Ju**  
  Korea Advanced Inst. of Science and Tech.

- **Park, Bong-Gyun**  
  LIG Nex1

- **Tahk, Min-Jea**  
  Korea Advanced Inst. of Science and Tech.

### WeBT1.3

**Optimal Weapon Target Assignment Based on a Geometric Approach (I), pp. 341-346.**

- **Leboucher, Cedric**  
  MBDA France

- **Le Menec, Stephane**  
  MBDA France

- **Kotenkoff, Alexandre**  
  MBDA

- **Shin, Hyo-Sang**  
  Cranfield Univ.

- **Tsourdos, Antonios**  
  Cranfield Univ.

## WeBT2

### Zuse Hall

**Space Robotics (Regular Session)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00-10:20</td>
<td>WeBT2.1</td>
</tr>
<tr>
<td>10:20-10:40</td>
<td>WeBT2.2</td>
</tr>
<tr>
<td>10:40-11:00</td>
<td>WeBT2.3</td>
</tr>
</tbody>
</table>

#### WeBT2.1

**Optimal Rendezvous Path Planning to an Uncontrolled Tumbling Target, pp. 347-352.**

- **Michael, Johannes**  
  Univ. of the Federal Armed Forces Munich

- **Chudej, Kurt**  
  Univ. of Bayreuth

- **Gerdts, Matthias**  
  Univ. of the Federal Armed Forces Munich

- **Pannek, Juergen**  
  Univ. of the Federal Armed Forces Munich

#### WeBT2.2

**New Testing Facility for Proximity Operations in Space, pp. 353-358.**

- **Regoli, Leonardo**  
  Univ. of Wurzburg

- **Herrmann, Christian**  
  Univ. of Wurzburg

- **Ravandoor, Karthik**  
  Univ. of Wurzburg

- **Schilling, Klaus**  
  Univ. of Wurzburg

#### WeBT2.3

**New Advances of Chinese Spacecraft Control Technologies, pp. 359-363.**

- **Zhang, Duzhou**  
  Beijing Inst. of Control Engineering
## Invited Session on Spacecraft Guidance, Navigation and Control I (Invited Session)

**Chair:** Somov, Yevgeny  
**Co-Chair:** Somov, Sergey  
**Organizer:** Somov, Yevgeny

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
</table>
| 08:30-08:50   | Dynamics Features and Algorithms of Gyroscopic Control of Large-Scale Flexible Spacecraft (I), pp. 364-369. | ThAT1.1      | Rutkovsky, Vladislav Yu. Inst. OF CONTROL SCIENCES  
                  Sukhanov, Victor Inst. OF CONTROL SCIENCES  
                  Glumov, Victor Inst. OF CONTROL SCIENCES |
| 08:50-09:10   | Guidance and Control for the Propulsion Phase of Planetary Landing (I), pp. 370-375. | ThAT1.2      | Canuto, Enrico Pol. di Torino  
                  Molano-Jimenez, Andres Pol. di Torino  
                  Perez-Montenegro, Carlos Pol. di Torino |
| 09:10-09:30   | Attitude & Orbit Digital and Pulse-Width Control of Large-Scale Communication Spacecraft (I), pp. 376-381. | ThAT1.3      | Somov, Yevgeny Samara State Tech. Univ.  
                  Rayevsky, Valentine ISS Res. JSC  
                  Titov, Gennady Res. ISS JSC  
                  Yakimov, Yevgeny Res. ISS JSC |

## Mission Control and Operations (Regular Session)

**Chair:** Schilling, Klaus  
**Co-Chair:** Schwedhelm, Kai

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
</table>
| 08:30-08:50   | VAMOS - Verification of Autonomous MissionPlanning Onboard a Spacecraft, pp. 382-387. | ThAT2.1      | Wille, Benjamin Univ. of the Federal Armed Forces Munich, Neubiberg D – 855  
                  Wörle, Maria DLR / GSOC  
                  Lenzen, Christoph DLR / GSOC |
| 08:50-09:10   | Advanced Autonomy for Low Cost Ground Stations, pp. 388-392. | ThAT2.2      | Freimann, Andreas Univ. Wuerzburg  
                  Kleinschrodt, Alexander Univ. Wuerzburg  
                  Schmidt, Marco Univ. Wuerzburg  
                  Schilling, Klaus Univ. Wuerzburg |

## Invited Session on Spacecraft Guidance, Navigation and Control II (Invited Session)

**Chair:** Somov, Yevgeny  
**Co-Chair:** Somov, Sergey  
**Organizer:** Somov, Yevgeny

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
</table>
| 09:45-10:05   | In-Flight Calibration of Attitude Determination Systems for Information Mini-Satellites (I), pp. 393-398. | ThBT1.1      | Somov, Yevgeny Samara State Tech. Univ.  
                  Butyrin, Sergey Samara State Tech. Univ.  
                  Siguerdidjane, Houria SUPELEC  
                  Hajiyev, Chingiz Istanbul Tech. Univ.  
                  Fedosov, Viktor Aeronautical Res. and Test Inst. |
                  Somov, Sergey Samara State Tech. Univ.  
                  Butyrin, Sergey Samara State Tech. Univ. |
Modern Attitude Control and Co-Design for the Biomass Satellite (Earth Explorer Core Mission 7) (I), pp. 405-410.

- Massotti, Luca
- Arcioni, Marco
- Silvestrin, Pierluigi
- Ankersen, Finn
- Casasco, Massimo

Flexible Structure Control and Decision Making and Autonomy (Regular Session)

Chair: Canuto, Enrico
Co-Chair: Schiano, Fabrizio


- Bihl, Trevor
- Mitchell, Jerrel
- Irwin, Dennis

Agile Attitude Control and Vibration Suppression of Flexible Spacecraft Using Control Moment Gyros, pp. 417-422.

- Okubo, Hiroshi
- Kuwamoto, Shinichi

VIMOS - Autonomous Image Analysis on Board of BIROS, pp. 423-428.

- Goetz, Katharina Alice Maria
- Huber, Felix
- Schönermark, Maria


- Panferov, Alexander
- Nebylov, Alexander
- Brodskiy, Sergey

Aircraft/Helicopter Dynamics, Control, Guidance and Navigation (Regular Session)

Chair: Castaldi, Paolo
Co-Chair: Bangert, Philip


- Usach-Molina, Hèctor
- Fons-Albert, Borja
- Vila-Carbó, Juan
- Crespo, Alfons

Dynamic Programming Applications to Flight Trajectory Optimization, pp. 441-446.

- Harada, Akinori
- Miyazawa, Yoshikazu

Application of L1 Adaptive Controller to Longitudinal Dynamics of a High Manoeuvrability Aircraft, pp. 447-452.

- Ene, Costin
- Whidborne, James F
- Stoica, Adrian-Mihail


- Mohamed, Majeed
- Singh, Jatinder
**ThCT2**  
**Guidance, Control and Estimation Theory and High Accuracy Pointing (Regular Session)**  

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
<th>Affiliations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ThCT2.1</td>
<td>Identification of a Hammerstein Model for an Aerospace Electrohydraulic Servovalve</td>
<td>Garro Brito, Alexandro Leite Filho, Waldemar C. Hemerly, Elder</td>
<td>Inst. de Aeronáutica e Espaço Space and Aeronautics Inst. Inst. Tecnologico De Aeronautica</td>
</tr>
<tr>
<td>ThCT2.2</td>
<td>Parameter Identification Methods for Free-Floating Space Robots with Direct Torque Sensing</td>
<td>Rackl, Wolfgang Lampariello, Roberto Albu-Schaeffer, Alin</td>
<td>DLR (German Aerospace Center) Deutsches Zentrum für Luft- und Raumfahrt e.V. / The German Aero German Aerospace Center (DLR)</td>
</tr>
<tr>
<td>ThCT2.3</td>
<td>Nonlinear Model Predictive Control of PEM Fuel Cell Systems for Generation of Exhaust Gas with Low Oxygen Content</td>
<td>Schultz, Martin Horn, Joachim</td>
<td>Helmut-Schmidt-Univ. / Univ. of the Federal Armed Forces Helmut-Schmidt-Univ. / Univ. of the Federal Armed Forc</td>
</tr>
<tr>
<td>ThCT2.4</td>
<td>The Design, Ground Test and Flight Validation of a High Accuracy Servo Scheme for Control Moment Gyroscope Application</td>
<td>Zhou, Daning Zhai, Baicheng Wei, Dazhong Zhang, Jiyang Lei, Yongjun Zhang, Haitong</td>
<td>Beijing Inst. of Control Engineering Beijing Inst. of Control Engineering Beijing Inst. of Control Engineering Beijing Inst. of Control Engineering Beijing Inst. of Control Engineering</td>
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</table>

**ThDT1**  
**Invited Session on Innovative Control Techniques and Validation: From Theory to Aeronautic and Space Industrial Application (Invited Session)**  

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
<th>Affiliations</th>
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<tbody>
<tr>
<td>ThDT1.1</td>
<td>SAFE-V Launcher Validation Framework and Controller Optimization</td>
<td>Ganet-Schoeller, Martine Maurice, Guillaume Bennani, Samir</td>
<td>ASTRUIUM Space Transportation ASTRUIUM Space Transportation European Space Agency</td>
</tr>
<tr>
<td>ThDT1.2</td>
<td>Flat Stellar Dynamic Filter for Gyroless Attitude Estimation</td>
<td>Pittet, Christelle Cazaurang, Franck Lavigne, Loic</td>
<td>CNES Univ. Bordeaux I Univ. Bordeaux I</td>
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<tr>
<td>ThDT1.3</td>
<td>Stability Analysis of Pulse-Modulated Systems with an Application to Space Launchers</td>
<td>Chaudenson, Julien Fetzer, Matthias Scherer, Carsten W. Beauvois, Dominique Sandou, Guillaume Bennani, Samir Ganet-Schoeller, Martine</td>
<td>SUPELEC Univ. of Stuttgart Department of Mathematics, Univ. of Stuttgart Supelec SUPELEC European Space Agency ASTRUIUM Space Transportation</td>
</tr>
<tr>
<td>ThDT1.4</td>
<td>A New Attitude Control Design Approach for Flexible Satellites</td>
<td>Guy, Nicolas</td>
<td>ONERA</td>
</tr>
</tbody>
</table>
Alazard, Daniel  
Univ. de Toulouse - ISAE

Cumer, Christelle  
ONERA

Charbonnel, Catherine  
Thales Alenia Space

15:20-15:40  
ThDT1.5

Application of Robust Antiwindup Design to the Longitudinal Aircraft Control to Cover Actuator Loss (I), pp. 506-511.

Puyou, Guilhem  
Airbus

Biannic, Jean-Marc  
ONERA

Boada-Bauxell, Josep  
AIRBUS Operations SAS

15:40-16:00  
ThDT1.6


Kron, Aymeric  
Univ. of Sherbrooke

Simard Bilodeau, Vincent  
NGC Aerospace Ltd

Ankersen, Finn  
European Space Agency

Alger, Michael William Richard  
NGC Aerospace

ThDT2  
Zuse Hall

Spacecraft Guidance, Navigation and Control II (Regular Session)  
Co-Chair: Freimann, Andreas  
Univ. of Würzburg

14:00-14:20  
ThDT2.1

Attitude Stability Analysis for an Earth Pointing, Magnetically Controlled Spacecraft, pp. 518-523.

Della Rossa, Fabio  
Pol. di Milano

Dercole, Fabio  
Pol. di Milano

Lovera, Marco  
Pol. di Milano

14:20-14:40  
ThDT2.2

Accurate and Stable Control of Shenzhou Spacecraft in Rendezvous and Docking, pp. 524-528.

Xie, Yongchun  
Beijing Inst. of Control Engineering

14:40-15:00  
ThDT2.3

Safe Approach Trajectory for Rendezvous, pp. 529-534.

Chen, Changqing  
Beijing Inst. of Control Engineering

Xie, Yongchun  
Beijing Inst. of Control Engineering

Shi, Lei  
Beijing Inst. of Control Engineering

15:00-15:20  
ThDT2.4


Balas, Mark  
Univ. of Wyoming

Frost, Susan  
NASA Ames Res. Center

15:20-15:40  
ThDT2.5

Sun Tracking Controller for UKube-1 Using Magnetic Torquer Only, pp. 541-546.

Kim, Jongrae  
Univ. of Glasgow

Kevin, Worrall  
Clyde Space Ltd.

15:40-16:00  
ThDT2.6

Spacecraft with Very High Pointing Stability: Experiences and Lessons Learned, pp. 547-552.

Yoshida, Norimasa  
Mitsubishi Electric Corp.

Takahara, Osamu  
Mitsubishi Electric Corp.

Kodeki, Kazuhide  
Mitsubishi Electric Corp.
## FrAT1
### Spacecraft Guidance, Navigation and Control III (Regular Session)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
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</thead>
<tbody>
<tr>
<td>08:30</td>
<td>FrAT1.1</td>
<td>Model-Based On-Board Realtime Thruster Fault Monitoring</td>
<td>Posch, Andre, Schwientek, Alexander O., Sommer, Josef, Fichter, Walter</td>
</tr>
<tr>
<td>08:50</td>
<td>FrAT1.2</td>
<td>Static Input Allocation for Reaction Wheels Desaturation Using Magnetorquers</td>
<td>Tregouet, Jean-François, Arzelier, Denis, Zaccarian, Luca</td>
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<tr>
<td>09:10</td>
<td>FrAT1.3</td>
<td>Model Predictive Control of Hayabusa2 Probe in the Approach Phase to an Asteroid</td>
<td>Mimasu, Yuya, Terui, Fuyuto, Yasuda, Seiji, Uo, Masashi</td>
</tr>
</tbody>
</table>

## FrBT1
### Spacecraft Guidance, Navigation and Control IV (Regular Session)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
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</thead>
<tbody>
<tr>
<td>10:05</td>
<td>FrBT1.2</td>
<td>Remote Attitude Control Using Delayed Visual Information - Nemo HD Case Study</td>
<td>Klancar, Gregor, Matko, Drago, Music, Gasper, Rodic, Tomaz, Blazic, Saso</td>
</tr>
</tbody>
</table>

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FrAT1: Turing Hall
FrBT1: Turing Hall

Chair: Balas, Mark (Univ. of Wyoming)
Co-Chair: Ravandoor, Karthik (Univ. of Wuerzburg)

Chair: Kleinschrodt, Alexander (Univ. of Wuerzburg)