

Program

# 4<sup>th</sup> Conference on Aerospace Robotics (CARO4) with Workshop on Space Microelectronics (WoSM)

Zielona Góra (Poland), 06-08.07.2022

06.07.2022 Wednesday	07.07.2022 Thursday	08.07.2022 Friday
<p><b>9.00-9.10 Welcome</b> <i>Jurek Sęsiadek and Marek Banaszekiewicz</i></p> <p><b>9.10-11.00 Session I – Orbital Robotics</b> Chair: <i>Karol Seweryn</i></p> <p>9.10-10.00 <b>Invited presentation:</b> <i>J.Sęsiadek (Carlton Uni., Canada)</i>, Space robotics - a survey</p> <p>...</p>	<p><b>9.00-11.00 Session IV – Sensors and Actuators</b> Chair: <i>Elżbieta Jarzębowska</i></p> <p>9.00-9.40 <b>Invited presentation:</b> <i>M.Rognant (Onera, France)</i>, PULSAR: Testing the Technologies for On Orbit Assembly of a Large Telescope</p> <p>...</p>	<p><b>9.00-11.00 WoSM: Session VI - Space electronics</b> Chair: <i>Krzysztof Piotrowski</i></p> <p>9.00-9.40 <b>Invited presentation:</b> <i>M.Krstić (Uni of Potsdam, Germany)</i>, Designing radiation hard circuits - multi-level approach</p> <p>...</p>
<b>11.00-11.15 Coffee break</b>	<b>11.00-11.15 Coffee break</b>	<b>11.00-11.15 Coffee break</b>
<p><b>11.15-12.55 Session II – Control Systems I</b> Chair: <i>Jurek Sęsiadek</i></p> <p>11.15-11.55 <b>Invited presentation:</b> <i>R.Lichtenheldt (DLR, Germany)</i>, The DLR Scout Rover - an agile, robust robot for extraterrestrial cave exploration</p> <p>...</p>	<p><b>11.15-13.15 Session V – Control Systems II</b> Chair: <i>Ignacy Dułęba</i></p> <p>11.15-11.55 <b>Invited presentation:</b> <i>P.Kulinowski (AGH University of Science and Technology, Poland)</i>, TOLRECON - Tandem of Lunar Regolith Conveyors</p> <p>...</p>	<p><b>11.15-13.15 WoSM: Session VII - Communication systems</b> Chair: <i>Miloš Krstić</i></p> <p>11.15-11.55 <b>Invited presentation:</b> <i>W.Dębski (Silicon Radar, Germany)</i>, Radars – sensors of the future</p> <p>...</p>
<b>12.55-15.00 Lunch break</b>	<b>13.15-15.30 Lunch break</b>	<b>13.15-15.15 Lunch break and adjourn</b>
<p><b>15.00-17.20 Session III – In situ Resource Utilization</b> Chair: <i>Piotr Kulinowski</i></p> <p>15.00-15.40 <b>Invited presentation:</b> <i>J.Ciążela (ING PAN, Poland)</i>, Ore prospecting on the Moon and Mars: geological conditions and technical capabilities</p> <p>...</p>	<p><b>15.30-17.00 Panel Session - Space robotics in space activities</b> Moderator: <i>Marek Banaszekiewicz</i></p> <p>Panelists: <i>Zbigniew Burdzy (POLSA)</i>, <i>Jarostaw Flakowski (Lubuskie Voivodship Marshal Office)</i>, <i>Maria Mrówczyńska (University of Zielona Góra)</i>, <i>Karol Seweryn (CBN PAN)</i>, <i>Urszula Szulewicz (Hertz Systems)</i></p>	<p><b>15.15-17.15 Special Session: SpaceRegion Project IHP and CBK PAN – summary of Interreg project</b></p>
<b>19.00- Welcome meeting (with a walking tour of Zielona Góra city center)</b>	<b>19.00- Gala Dinner (at Palmiarnia Restaurant)</b>	

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**06.07.2022 Wednesday**

**9.00-9.10 Welcome**

*Jurek Sęsiadek and Marek Banaszekiewicz*

**9.10-11.00 Session I – Orbital Robotics**

Chair: *Karol Seweryn*

**9.10-10.00 Invited presentation:** *Jurek Sęsiadek (Carlton Uni., Canada),*  
Space robotics - a survey

**10:00-10:20** *Rizwan Tariq Syed, Markus Ulbricht, Krzysztof Piotrowski and Milos Krstic,*  
A Survey on Fault-Tolerant Methodologies for Deep Neural Networks

**10:20-10:40** *Tomasz Rybus, Konrad Aleksiejuk, Fatina Liliana Basmadji and Adam Sikorski,*  
Application of the Obstacle Vector Field (OVF) method for trajectory planning of a planar 3 DoF manipulator in simulated microgravity conditions

**10:40-11:00** *Marek Banaszekiewicz, Marek Węgrzyn, Fatina Liliana Basmadji and Mirosław Galicki,*  
Robust trajectory tracking control of space manipulators in extended task space

**11.00-11.15 Coffee break**

**11.15-12.55 Session II – Control Systems I**

Chair: *Jurek Sęsiadek*

**11.15-11.55 Invited presentation:** *Roy Lichtenheldt (DLR, Germany),*  
The DLR Scout Rover - an agile, robust robot for extraterrestrial cave exploration

**11:55-12:15** *Marcin Kłak and Elżbieta Jarzębowska,*  
Dynamics Contact Model of a Free-Floating Space Manipulator Grasping a Rotating Target

**12:15-12:35** *Filip Dyba, Tomasz Rybus, Mateusz Wojtunik and Fatina Liliana Basmadji,*  
Active 6 DoF force/torque control based on Dynamic Jacobian for free-floating space manipulator

**12:35-12:55** *Grzegorz Pajak and Iwona Pajak,*  
Sub-optimal Motions of Mobile Manipulators with Control Constraints

**12.55-15.00 Lunch break**

**15.00-17.20 Session III – In situ Resource Utilization**

Chair: *Piotr Kulinowski*

**15.00-15.40 Invited presentation:** *Jakub Ciqżela (ING PAN, Poland),*  
Ore prospecting on the Moon and Mars: geological conditions and technical capabilities

**15:40-16:00** *Karol Seweryn et al,*  
Proposal of Open pit mine on Moon

**16:00-16:20** *Petr Konečný, Jacek Katzer, Janusz Kobaka and Karol Seweryn,*  
Estimation of the Regolith Mining Pit Size for the Covering Lunar Habitat by Protective Layer

**16:20-16:40** *Przemysław Młynarczyk, Adam Kolusz and Alberto Gallina,*  
Sensitivity analysis of the DEM model numerical parameters on the value of the angle of repose of the lunar regolith analog

**16:40-17:00** *Janusz Kobaka, Jacek Katzer and Karol Seweryn,*  
Magnetic Separation of Lunar Regolith as its Beneficiation for Construction Effort on the Moon

**17:00-17:20** *Arkadiusz Tkacz and Karol Seweryn,*  
The impact of lunar environment on energy efficiency of selected mining activities

**19.00- Welcome meeting (with a walking tour of Zielona Góra city center)**

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**07.07.2022 Thursday**

**9.00-11.00 Session IV – Sensors and Actuators**

Chair: *Elżbieta Jarzębowska*

**9.00-9.40 Invited presentation:** *Mathieu Rognant (Onera, France),*  
PULSAR: Testing the Technologies for On Orbit Assembly of a Large Telescope

**9:40-10:00** *Ignacy Duleba and Iwona Karcz-Duleba,*  
Many Faces of Singularities in Robotics

**10:00-10:20** *Hamdan Alatresh Bitlmal, Malik Al-Isawi and Jurek Sasiadek,*  
Design and Development Optical Angle Sensor

**10:20-10:40** *Patryk Bartkowiak, Radosław Patelski, Marta Kwiatkowska and Dariusz Pazderski,*  
System Architecture for Development and Supervision of Robotic Astronomical Telescope

**10:40-11:00** *Ignacy Kraciuk, Dymitr Osiński, PIAP Space,*  
A Survey of Functions for a Multipurpose Gripper for On-Orbit Satellite Servicing

**11.00-11.15 Coffee break**

**11.15-13.15 Session V – Control Systems II**

Chair: *Ignacy Dulęba*

**11.15-11.55 Invited presentation:** *Piotr Kulinowski (AGH University of Science and Technology, Poland),*  
TOLRECON - Tandem of Lunar Regolith Conveyors

**11:55-12:15** *Mateusz Wojtunik, Piotr Łuczak, Tomasz Rybus and Grzegorz Granosik,*  
Application of the KUKA KUBE test-bed for the hardware-in-the-loop validation of the space manipulator control system

**12:15-12:35** *Hamdan Alatresh Bitlmal, Malik Al-Isawi and Jurek Sasiadek,*  
Optimal State Estimation via Adaptive Fuzzy Particle Filter

**12:35-12:55** *Piotr Palma, Tomasz Rybus and Karol Seweryn,*  
Application of Impedance Control of the Free Floating Space Manipulator for Removal of Space Debris

**12:55-13:15** *Malik Al-Isawi, Jurek Sasiadek and Ammar Shuker,*  
Advanced Quadrotor Fractional Order Controller Based on Particle Swarm Optimization

**13.15-15.30 Lunch break**

**15.30-17.00 Panel Session - Space robotics in space activities**

Moderator: *Marek Banaszekiewicz*

Panelists: *Zbigniew Burdzy (POLSA), Jarosław Flakowski (Lubuskie Voivodship Marshal Office),  
Maria Mrówczyńska (University of Zielona Góra), Karol Seweryn (CBN PAN),  
Urszula Szulewicz (Hertz Systems)*

**19.00- Gala Dinner (at Palmiarnia Restaurant)**

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Workshop on Space Microelectronics (WoSM)  
(conjunction with 4<sup>th</sup> Conference on Aerospace Robotics, CARO4)  
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**08.07.2022 Friday**

**9.00-11.00 WoSM: Session VI - Space electronics**

Chair: *Krzysztof Piotrowski*

**9.00-9.40 Invited presentation:** *Miloš Krstić (Uni of Potsdam, Germany),*  
Designing radiation hard circuits - multi-level approach

**9.40-10.00** *Kamil Wołoszyn, Krzysztof Turchan, Michał Rąpała and Krzysztof Piotrowski,*  
AI4U: Modular Framework for AI Application Design

**10.00-10.20** *Dariusz Janiszewski, Alessandro Veronesi, Rizwan Tariq Syed, Marek Węgrzyn,*  
*Krzysztof Piotrowski and Marek Banaszekiewicz,*  
HLS approach for robust control algorithm implementation in FPGA

**10.20-10.40** *Roman Wawrzaszek, Kamil Jasiński, Tomasz Rudnicki, Kamil Ber, Karol Mostowy,*  
*Tomasz Kowalski and Piotr Orleański,*  
System of GLOWS instrument designed for UV photons registration on board of NASA's IMAP mission to L1

**10.40-11.00** *Damian Nagajek, Marek Węgrzyn, Mirosław Galicki and Marek Banaszekiewicz,*  
Design of control system for mobile robot

**11.00-11.15 Coffee break**

**11.15-13.15 WoSM: Session VII - Communication systems**

Chair: *Miloš Krstić*

**11.15-11.55 Invited presentation:** *Wojciech Dębski (Silicon Radar, Germany),*  
Radars – sensors of the future

**11.55-12.15** *Janusz Jabłoński, Marek Węgrzyn and Paweł Wolański,*  
Safe authentication for space applications

**12.15-12.35** *Roman Wawrzaszek, Nils Thernstrom, Artur Kobylkiewicz, Ambroise Bidaux-Sokołowski*  
*and Karol Gliwa,*  
Comparison of GNSS filters and combiners in a context of design of multiband GNSS space receivers

**12.35-12.55** *Michał Rąpała, Marek Banaszekiewicz, Mirosław Galicki, Marek Węgrzyn, Damian Nagajek,*  
*Kamil Wołoszyn, Krzysztof Turchan and Krzysztof Piotrowski,*  
Make your robot see. A survey on visual navigation technology

**12.55-13.15** *Marek Węgrzyn, Fatina Liliana Basmadji, Michał Rąpała, Mirosław Galicki*  
*and Marek Banaszekiewicz,*  
Distributed system for testing of space robot control systems

**13.15-15.15 Lunch break and adjourn**

**15.15-17.15 Special Session: SpaceRegion Project  
IHP and CBK PAN – summary of Interreg project**