



Wroclaw University  
of Science and Technology  
Faculty of Mechanical Engineering



**INTERNATIONAL CONFERENCE  
OF THE POLISH SOCIETY OF BIOMECHANICS**  
**BIOMECHANICS 2023**

**CONFERENCE PROGRAMME**



**WROCLAW UNIVERSITY OF SCIENCE AND TECHNOLOGY,  
FACULTY OF MECHANICAL ENGINEERING, WROCLAW, POLAND**



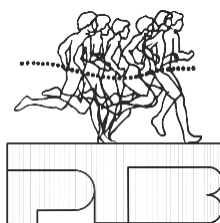
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**THE POLISH SOCIETY OF BIOMECHANICS**



**SCIENTIFIC PATRONAGE**



*European Society of  
Biomechanics*



*Association of Polish  
Engineers and Technicians,  
Wrocław Branch*



*Biomechanics Section of the  
Committee on Mechanics of the  
Polish Academy of Sciences*



Wrocław University  
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Faculty of Mechanical Engineering





Ministry of Education and Science  
Republic of Poland

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Project co-financed by the state budget, granted by the Ministry of Education and Science  
Republic of Poland under the Programme “Excellent Science II” – project No.  
KONF/SN/0491/2023/012.



Wrocław University  
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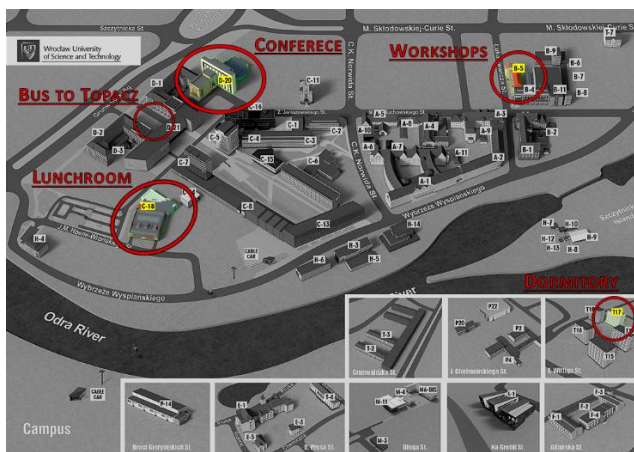


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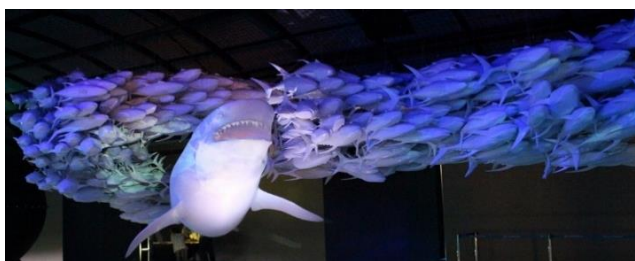


# 13.09.2023 WEDNESDAY - WORKSHOPS

WROCLAW UNIVERSITY OF SCIENCE  
AND TECHNOLOGY,  
FACULTY OF MECHANICAL ENGINEERING,  
WROCLAW, POLAND  
B4/B5 buildings, Lukasiewicza street



13.09.2023 Wednesday, Łukasiewicza 7/9 street; B5, Polish day	
8:00-10:00	Rejestracja uczestników warsztatów, B-5/3
9:00-9:45	<i>Wykład wprowadzający: Celina Pezowicz "Biomechanika inżynierska wczoraj i jutro" B4/2.41</i>
10:00 - 15:00	<i>"Metody eksperymentalne w pomiarach tkanek miękkich i twardych"</i> <i>"Technologia Motion Capture technology w analizie ruchu człowieka"</i> B5/3-5; L6-1-L6-2
	10:00-12:30   I blok: Pomiar
	12:45 -13:30   Lunch (SKS - Strefa Kultury Studenckiej)
	13:30 -15:00   II blok: Analiza uzyskanych wyników
15:30 -18:00	H2O cząsteczką życia, z wizytą w Hydropolis



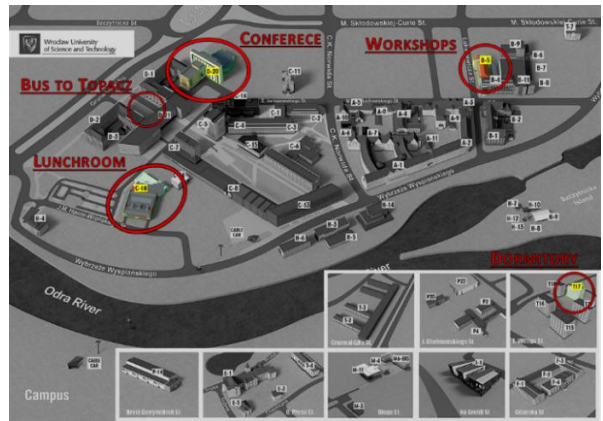
Wrocław University  
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**BIOMECHANICS2023**  
13 - 16 September 2023  
Wrocław, Poland

**14.09.2023 THURSDAY**, Janiszewskiego 8 street; building D20

**WROCLAW UNIVERSITY OF SCIENCE  
AND TECHNOLOGY,  
CONGRESS CENTRE  
D20 building,  
Janiszewskiego 8 street  
WROCLAW, POLAND**



8:00-12:00	Registration, <b>Main Hall</b>
9:00 - 9:45	Welcome Opening Remarks ( <b>Room 10 AC</b> )
9:45 - 10:30	<b>Invited Lecture: Christian Hellmich "A unified theoretical approach to the hierarchical mechanics of hard and soft tissues"</b> ( <b>Room 10 AC</b> ) <i>Moderator: Celina Pezowicz</i>
10:30 - 11:00	<b>Coffee Break</b>
11:00 – 12:30	<b>Session A: Tissue Biomechanics (Room 10 AC)</b> <i>Moderators: Christian Hellmich, Wojciech Wolański</i>
11:00 - 11:15	<i>A. Tomaszewska, S. Piszczatowski "Analysis of bone remodelling in the mandible with the implant reconstruction of bone defect"</i>
11:15 - 11:30	<i>P. Borkowski "Temporal bone support in a finite element analysis of bone conduction stimulation on the otic capsule"</i>
11:30 - 11:45	<i>J. Małachowski, Ł. Mazurkiewicz, K. Pietroń, K. Sybilski "Determination of bone stiffness using multi-model optimisation"</i>
11:45 - 12:00	<i>I. Ważydrąg, S. Łagan "The development process of the tissue's direct piezoelectric effect measurement device"</i>



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# 14.09.2023 THURSDAY, Janiszewskiego 8 street; building D20

12:00 - 12:15	M. Troka, K. Szepietowska, I. Lubowiecka "Clustering of Strains Datasets of Human Abdominal Wall with Self-Organising Maps"
12:15 - 12:30	M. Jasiński, M. Zadoń "Mathematical modelling of coupled thermal and chemical effects in biological tissue during laser irradiation"
<b>11:00 - 12:30</b>	<b>Session B: Sport Biomechanics (Room 10 D)</b> Moderators: Adam Czaplicki, Małgorzata Sobera
11:00 -11:15	A. Ferreira, M. Górski, P. Tabor, J. Gajewski "Gender differences in kinematic determinants of shuttlecock velocity and flight angle in the badminton forehand smash"
11:15 - 11:30	S. Kuliś, J. Gajewski "Kinematic analysis of sway motions of elite dance sport competitors"
11:30 - 11:45	M. Błażkiewicz, R. Borkowski, K. Kaczmarczyk, A. Zdrodowska, M. Jarocka "Gait kinetics during induced perturbations in the pre-swing phase of the gait cycle"
11:45 – 12:00	A. Hadamus, B. Osuch, K. Wiaderna, T. Jankowski, A. Ferenc, D. Białoszewski "Influence of a single session of occlusion training on time parameters in isokinetic knee flexion-extension strength measurements"
12:00 - 12:15	B. Bacik, G. Sobota, K.A. Bacik, T. Rogers "Velocity distribution in a pedestrian contraflow experiment"
12:15 - 12:30	P. Wodarski, J. Jurkojć, J. Michalska, A. Kamieniarz, G. Juras, M. Gzik "Stock market indexes in assessing balance of patients with Parkinson's disease"
<b>12:30 - 13:00</b>	<b>Meden-Inmed - Jerzy Bartodziej "Markerless 3D tracking system" (Room 10 AC)</b>
<b>13:00 - 14:00</b>	<b>Lunch (SKS - Strefa Kultury Studenckiej)</b>
<b>14:00 – 14: 40</b>	<b>Invited Lecture: Dorota Bociąga "The future of medicine and science with 3D bioprinting", (Room 10 AC)</b> Moderator: Jarosław Filipiak
<b>14:45 - 16:15</b>	<b>Session C: Biomaterials (Room 10 AC)</b> Moderators: Dorota Bociąga, Adam Mazurkiewicz
14:45 - 15:00	A. Nikodem "Investigation of 24-month biodegradation of PCL scaffolds with the addition of bioglass and Zn using computer microtomography"
15:00 - 15:15	K. Żerdzicki, W. Korbut , A. Kondrusik "Compressive properties of polyurethane foam mimicking trabecular tissue in femoral head of synthetic bones"
15:15 -15:30	A. Cieślak, M. Łabowska, A. Krakos (Podwin), J. Kulbacka, J. Detyna "Development of biocompatible hydrogel matrices for 3D cell cultures in lab-on-chip applications"
15:30 - 15:45	K. Arkusz, K. Pasik, A. Halinski "Comprehensive evaluation of urological Double-J stent encrustation: patient age, stent material, and implantation duration"
15:45 - 16:00	A. Gryko , P. Prochor "Finite element analysis of the influence of porosity and pore geometry on mechanical properties of orthopaedic scaffolds"
16:00 - 16:15	M. Skrodzka, M. Nowicka, M. Łabowska, J. Detyna, K. Matczyszyn "Mechanistic evaluation of the sodium alginate/chitosan hydrogel matrices for the release of a photosensitizing substance"



<b>14:45 - 16:15</b>	<b>Session D: Computer Methods in Biomechanics (Room 10 D)</b> <b>Moderators: Izabela Lubowiecka, Mariusz Ptak</b>
14:45 - 15:00	E. Majchrzak, B. Mochnacki "Sensitivity of biological tissue heating process described by Cattaneo-Vernotte equation with respect to perturbation of lag time"
15:00 - 15:15	G.P. Carmo, A. Silva, M. Dymek, M. Ptak, F.A.O. Fernandes, R.J. Alves de Sousa "Development, Validation and a Case Study: The Female Finite Element Head Model"
15:15 -15:30	D. Iwan, P. Prochor "Numerical evaluation of the influence of selected parameters of orthopaedic scaffolds on load transfer within long bone"
15:30 - 15:45	R. Zabłotni, R. Rusinek "Influence of double excitation in Lumped Parameter Model of Implanted Human Middle Ear"
15:45 - 16:00	N. Kizilova, L. Batyuk "Comparative analysis of rheological models for human blood"
16:00 - 16:15	M. Roszak, M. Mamys, D. Pyka, M. Bocian, K. Jamroziak "Analytical and numerical analysis of soft tissue penetration on the example of a pistol ammunition shot"
<b>16:15 – 17:30</b>	<b>Poster Session, Coffee Take and Go (1<sup>st</sup> floor)</b> <b>Moderators: Anna Hadamus, Wiktoria Wojnicz; Jerzy Detyna, Robert Michnik</b>
<b>P1</b>	K. Szepietowska, M. Staat, M. Rykaczewski, I. Lubowiecka "Personalised finite element models of the human abdominal wall under material model uncertainties"
<b>P2</b>	M. Kozuń, M. Kobielarz "The effect of atherosclerosis on the susceptibility of the human aorta to delamination"
<b>P3</b>	M. Kobielarz, A. Chwilkowska "Hyperelastic models comparison for abdominal aortic aneurysms"
<b>P4</b>	A. Mackiewicz, W. Dylewicz, J. Gach, I. Janus, T. Klekiel, A. Noszczyk-Nowak "Numerical analysis of damages chordae tendineae caused by myxomatous mitral valve disease in dogs"
<b>P5</b>	K. Marcuła, M. Kozuń, J. Filipiak "Mechanical characteristics determination of elastomer elements intended for the long gap esophageal atresia treatment"
<b>P6</b>	S. Szotek, J. Dawidowicz, A. Czogalla, K. Maksymowicz "Mechanical properties and microscopic characterization of human fascia lata"
<b>P7</b>	L.F. Ciupik, A. Kierzkowska, G. Pająk, P. Powchowicz, F. Andruskiewicz "Innovative 3D-Ti-Truss procedure in biomechanical spinal stabilisation"
<b>P8</b>	M. Zak, A. Nikodem, C. Pezowicz "Methods of evaluating mechanical parameters and the stability of the cervical interbody fusion cage"
<b>P9</b>	M. Zak, S. Szotek, K. Szkoła-Poliszuk, J. Filipiak, M. Wrzosek, K. Koltowski, P. Menartowicz, C. Pezowicz "Effect of DLC coating of growth-guidance system implants on changes in mechanical and kinematic properties of the spine"
<b>P10</b>	A. Ptak, A. Tomczak "Analysis of tribological properties of prosthetic materials under different conditions of use"
<b>P11</b>	K. Szkoła-Poliszuk, M. Zak, A. Brończyk, C. Pezowicz "Analysis of the degree of mechanical wear in the transpedicular stabilization of the spine"
<b>P12</b>	Z. Zajęc, A. Liber-Kneć, S. Łagan "Comparison of the surface and mechanical properties of low viscosity acrylic bone cements"
<b>P13</b>	D. Grygier, P. Kowalewski, M. Dziubek, R. Jastrzębek, M. Opalka, J. Słowiński "The possibility of using the OrthoNail hybrid intramedullary nail in the human body without risk of decohesion"
<b>P14</b>	K. Jasiurkowska, J. Filipiak "Analysis of the influence of the bone fracture stabilization system on the biomechanics of the bone healing process"
<b>P15</b>	P. Kowalewski, D. Grygier, P. Krowicki, R. Jastrzębek, M. Opalka, M. Kielb "Evaluation of the possibility of using a hybrid magneto-mechanical drive in dynamic implants for lengthening long bones"
<b>P16</b>	A. Nikodem, M. Kozuń "The influence of cyclic loads on the structural properties of the femur bone tissue with osteoarthritis"
<b>P17</b>	S. Sikora, M. Pawlikowski, K. Jankowski "Preliminary 3D simulations of osteoarthritis in the knee joint"
<b>P18</b>	A. Cichański, K. Nowicki "Numerical analysis of trabecular bone microstructure for different voxel modelling methods"
<b>P19</b>	K. Wilińska, A. Nikodem, M. Kozuń "Mechanical properties of lattice structures fabricated using incremental technology"
<b>P20</b>	M. Głowacki, A. Mazurkiewicz "Methods to increase the strength of 3D printed PLA samples, a mini review"



# 14.09.2023 THURSDAY, Janiszewskiego 8 street; building D20

P21	J. Wolicka, J. Filipiak, A. Nikodem "Long-term observation of porous structure PLGA scaffold degradation in an incubation environment"
P22	E. Kawlewska, P. Czarnecki, A. Mol, T. Koszutki, M. Gzik, W. Wolański "Quantitative evaluation of the surgical treatment of cleft palate in infants"
P23	S. Klimas, A. Nikodem, M. Dobrzyński "An in-vitro evaluation of mechanical properties and thermographic investigation of selected dental materials used in primary dentition - glass-ionomer cement (Fuji IX) and composite (Charisma)"
P24	A. Szust, A. Wybraniec, D. Nasulicz, M. Maj "Analysis of ways to mount prosthetic dental bridge on implants"
P25	A. Piszko, A. Nikodem, P. Piszko, M. Dobrzyński "Fluoride release and selected chemo mechanical characteristics of three different commercially available dental materials for sealing"
P26	P. Stróżyk "Determination of intrinsic strength for the mandibular elevator muscles during unilateral mastication of different foodstuffs"
P27	K.H. Krawiec, D. Pyka, K. Jamroziak, A. Noszczyk- Nowak "Experimental and numerical tests of piercing the head of a pig subjected to a shock load"
P28	A. Czapliski, M. Jarocka, T. Sacewicz, J. Walawski "Spectral analysis of ground reactions evoked by patients after medial patellofemoral ligament (MPFL) reconstruction"
P29	A. Filipiak-Kaczmarek, K.Naplocha "Mechanical and structural properties of AZ91-based Ti reinforcement composite"
P30	M. Żuk , U. Czajkowska, K. Bulińska , M.Popek , M. Łopusiewicz "eMotion - system for computer aided rehabilitation- first usability tests on patients"
P31	B. Jasiński, P. Krowicki "Development of a simulator of surgical procedures supported by a vision system"
P32	A. Struzik "Relationships between leg stiffness and displacement of centre of mass during countermovement jumps to specific and various height"
P33	P. Aschenbrenner, R. Urbański, W. Erdmann "Mathematical model of a turn in alpine skiing"
P34	M. Syczewska, J. Michoński, M. Kalinowska, E. Szczerbik, R. Sitnik "Proper identification of body mass distribution modifies the outcome of the simulation. Preliminary results"
P35	N. Daniel, K. Sybilski, J. Malachowski "Technical aspects and limitations of signal acquisition during dynamic movement on the rowing ergometer"
P36	A. Szpala, M. Kołodziej, M. Kaźmierczak, Z. Bańkosz "Electromyographic activity of selected muscles of the lower limbs and the type of lunge in badminton"
P37	M. Kazalski, E. Świętek-Najwer "Electromyographic-based hand prosthesis movements control in Virtual Reality application for patient adaptation"
P38	A. Handke, S. Wudarczyk "Simulation Research on Kinematic and Dynamic Requirements of Prosthetic Hand During Grasping"
P39	A. Brachman, B. Bacik, G. Sobota "Gait stability evaluation after tripping simulated perturbation- assumptions of the project"
P40	D. Fryc, K. Wojciechowski "Gait kinematics asymmetry change induced by multijoint hip flexion resistance training – a preliminary research"
<b>19:00-22:00</b>	<b>Social Event: Muzeum Architektury (Architecture Museum)</b> Bernardyńska 5, 50-156 Wrocław; 51°6'34"N 17°2'32"E



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**BIOMECHANICS2023**  
13 - 16 September 2023  
Wrocław, Poland

**15.09.2023 FRIDAY**, Janiszewskiego 8 street; building D20

9:00 - 9:45	<b>Invited Lecture: Grace O'Connell „3D Modeling of the Intervertebral Disc: Direct relationships between tissue composition and model parameters” (Room 10 AC)</b> <i>Moderator: Marek Gzik</i>
9:45 - 10:00	<b>Coffee Break</b>
10:00 - 11:30	<b>Session E: Implant/Clinical Biomechanics (Room 10 AC)</b> <i>Moderators: Katarzyna Arkusz, Marek Jasiński</i>
10: 00 - 10:15	<i>P. Szymczyk-Ziółkowska, G Ziółkowski, D. Kęszycki, K. Kobiela, M. Rusińska, K. Sekuła "Advancements in Maxillofacial Reconstruction: Design and Manufacturing of Patient-Specific Implants"</i>
10:15 - 10:30	<i>S. Kalinowski, K. Szepietowska, E. Florentin, I. Lubowiecka "Optimisation of thickness of surgical implant used in abdominal hernia repair"</i>
10:30 - 10:45	<i>A. Bonik, L.F. Ciupik, A. Kierzkowska, E. Słoński "Ilio-sacral stabilization supported with bone cement"</i>
10:45 - 11:00	<i>P. Wądołowski "Numerical simulations of mandible angle fracture stabilization by means of mini-plate stabilization"</i>
11:00 - 11:15	<i>A. Wybraniec, A. Szust "A comparative study of mandibular bone implants using commercial reconstructive and a personalized implants"</i>
11:15 - 11:30	<i>D. Wdowicz, M. Ptak "Multitechnique analysis of dynamics of numerical pedestrian model for forensic applications"</i>
10:00 - 11:30	<b>Session F: Human Movement and Rehabilitation (Room 10 D)</b> <i>Moderators: Jacek Jurkojć, Michalina Błażkiewicz</i>
10: 00 - 10:15	<i>W. Wojnicz, B. Zagrodny, M. Ludwicki, A. Sobierajska-Rek, J. Jabłońska-Brudło, K. Forysiak "Assessment of type of control in chosen ADL performances of wheelchair patient with DMD and healthy adolescent: case study"</i>
10:15 - 10:30	<i>M. Sobera, P. Proskura "Trunk rotation and posture control asymmetry in children and young adults"</i>
10:30 - 10:45	<i>U. Czajkowska, M. Żuk, K. Smerd, C. Pezowicz, M. Popek, M. Łopusiewicz, K. Bulińska "Application of joint kinematics analysis to evaluate the correctness of users' exercise performance in a virtual reality environment"</i>
10:45 - 11:00	<i>P. Prochor, A. Szczerba, S. Piszczatowski "Concept of mechatronic device for supporting balance during locomotion with the function of recording kinematic parameters"</i>
11:00 - 11:15	<i>X. Zhao, J. Awrejcewicz, D. Grzelczyk, Y. Gu "A three-link model of a fetal lower limb for simulating the fetal kicking movement"</i>
11:15 - 11:30	<i>P. Zalewska, T. Guszczyn, S. Piszczatowski "Comparison of knee joint kinematics in patients after ACL reconstruction and ACL repair using Internal Bracing method"</i>
11:30 - 12:45	<b>Session of TECHNOMEX exhibitors (workshops): Wojciech Marszałek</b> <b>“IMU how it works - a few words about inertial systems” (Room 10 AC)</b>
11:30 - 13:00	<b>Meeting of the Biomechanics Section of the Polish Academy of Sciences (Room 114)</b>
13:00 - 14:00	<b>Lunch (SKS - Strefa Kultury Studenckiej)</b>
14:00 - 14:40	<b>Invited Lecture: Elizabeth Zimmermann „Multi-scale investigations of pediatric bone quality and the role of mechano-adaptation” (Room 10 AC)</b> <i>Moderator: Jerzy Małachowski</i>



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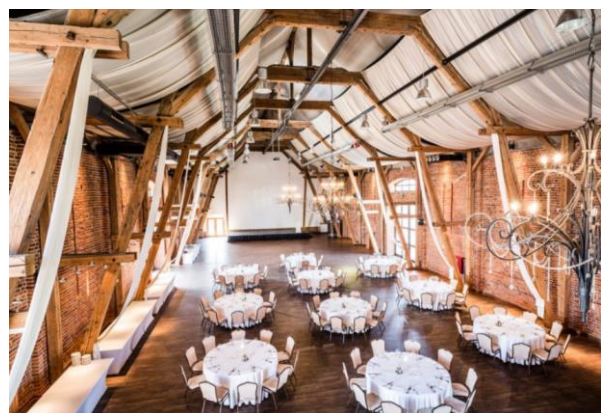
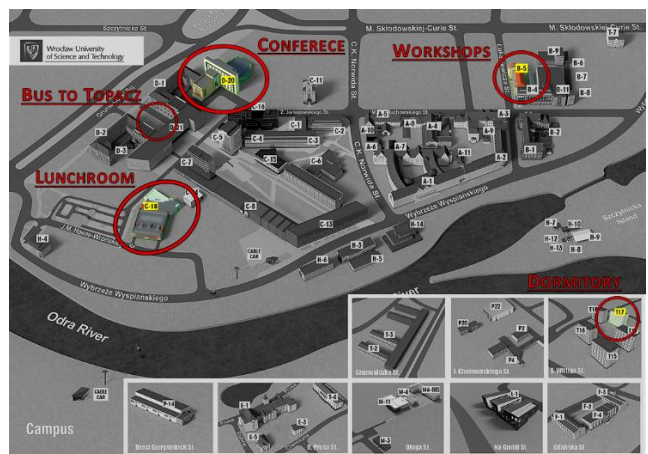


**BIOMECHANICS2023**  
13 - 16 September 2023  
Wrocław, Poland

15.09.2023 FRIDAY, Janiszewskiego 8 street; building D20

14:40 - 14:50	<b>Małgorzata Syczewska, PTB President "Academy of Polish Society of Biomechanics - introduction of the new initiative" (Room 10 AC)</b>
15:00 -16:15	<b>Special Session: MORECKI AND FIDELUS COMPETITION</b>
15:00-15:25	<b>Marta Chmura "Influence of postural adjustment in response to anterior-posterior ground perturbation"</b>
15:25 -15:50	<b>Adam Ciszewicz "Optimization and random sampling in selected aspects of modeling body joints with a multibody system method"</b>
15:55 - 16:15	<b>Jagoda Kurowiak "Analysis of material and mechanical properties of stents to increase the effectiveness of urethral stenosis treatment"</b>
16:15 – 16:30	<b>Coffee Break</b>
16:30 – 17:45	<b>Meeting of the Polish Society of Biomechanics, PTB (Room 10 AC)</b>
19:00	<b>Bus to Gala Dinner (Parking between D1/D2 buildings)</b>
20:00 – 24:00	<b>Gala Dinner: Zamek Topacz (Topacz Castle) ul.Templariuszy 1, 55-040 Kobierzyce; 51°2'3"N 16°59'24"E</b>

**BUS TO TOPACZ CASTLE:**  
**19:00**  
**PARKING BETWEEN**  
**BUILDING D1/D2**



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**BIOMECHANICS2023**  
13 - 16 September 2023  
Wrocław, Poland

**16.09.2023 SATURDAY**, Janiszewskiego 8 street; building D20

9:00 - 9:45	<b>Invited Lecture: prof Robert Iskander "Towards measuring intraocular pressure with optical coherence tomography" (Room 10 AC)</b> <i>Moderator: Ewa Majchrzak</i>
9:45 - 10:15	<b>Coffee Break</b>
10:15- 12:00	<b>Session G: Application in Biomechanics (Room 10 AC)</b> <i>Moderators: Szczepan Piszczatowski, Grzegorz Milewski</i>
10:15 - 10:30	<i>O. Denisov, N. Kizilova "Biomechanics and efficiency of n-link extremities of insects"</i>
10:30 - 10:45	<i>K. Kaczmarczyk, P. Bobowik, I. Wiszomirska, J. Gajewski, M. Błażkiewicz, M. Czuba, A. Maciejewska- Skrendo, Y. Matharu, K. Kulig "Developing a Literature-informed Intervention Protocol to Address post-COVID-19 Balance Disorders, Weakness and Muscle Fatigue in Individuals Aged 65+"</i>
10:45 - 11:00	<i>G. Ostrowski, M. Pawlikowski, P. Garbacz "Application of Transformer-Based Neural Networks in the Cells Segmentation Task in Fluorescent Microscopic Images"</i>
11:00 - 11:15	<i>M. Bobrowska, Z. Kosobucka, P. Tabor, E. Olszewska, J. Pniewski "Visual disorders and selected features of body posture - a pilot study"</i>
11:15 - 11:30	<i>D.Pyka, A. Nowicki, Ł. Pałka, A. Kurzawa, K.H. Krawiec, K. Jamroziak "Analysis of implant-bone junction fracture induced by force impulse in traffic collision"</i>
11:30 - 11:45	<i>R. Perz "Investigating Pediatric Head Trauma in Unmanned Aerial Vehicle Accidents"</i>
11:45 - 12:00	<i>M. Tomaszewski, M. Kucewicz, R. Rzepliński, J. Małachowski, B.M. Ciszek "Research on the flow characteristics in artificial vessels: an experimental investigation using the PIV method"</i>
12:00 - 12:45	<b>Final Words of Biomechanics 2023 Conference (Room 10 AC)</b>
13:00 - 14:00	<b>Lunch (SKS - Strefa Kultury Studenckiej)</b>



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