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Position: Professor

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1.Title of Research Project	Basis of Mathematics in nanomedicine structures and life sensing			
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5.Principal Investigator	Name	Stanislaw Janeczko		
	Affiliation	Faculty of Mathematis and Information Science, Warsaw University of Technology	position	Professor
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7.Key Words	Mathematical physics, Mathematics of Data Science and Machine			

9. Abstract for Research Report

The "WORKSHOP on Mathematics for Industry 2023" convened during September 25-29, 2023, at Warsaw University of Technology, Poland, under the joint auspices of the Faculty of Mathematics and Information Science, Warsaw University of Technology; Center for Advanced Studies, Warsaw University of Technology; and Institute of Mathematics for Industry, Kyushu University. With the participation of approximately 70 attendees, including researchers, students, and PhD candidates, the workshop served as a nexus for interdisciplinary dialogue and collaboration between the realms of mathematics and applied sciences.

The workshop program encompassed 25 individual talks and 5 mini-courses, each comprising 3 lectures, spanning a spectrum of topics such as topological data analysis, medical imaging methods, cryptography, and material engineering. Delivered by experts from Polish and Japanese institutions, the presentations illuminated the symbiotic relationship between abstract mathematical constructs and real-world engineering challenges, thereby fostering innovation and knowledge exchange.

The event not only facilitated the exploration of novel research directions but also catalyzed the establishment of international collaborations between academic environments in Poland and Japan. Through vibrant discussions and networking opportunities, attendees were inspired to leverage mathematical methodologies to address pressing industrial concerns and societal needs.

The conclusion of the project will be marked by the publication of a conference proceedings booklet, consolidating the insights and findings presented during the workshop. This compilation will serve as a valuable resource for scholars and practitioners alike, encapsulating the cutting-edge research at the interface of mathematics and industry showcased at the workshop. Furthermore, it will provide a platform for disseminating knowledge and fostering continued dialogue among the global scientific community.

In summary, the "WORKSHOP on Mathematics for Industry 2023" exemplified the transformative potential of interdisciplinary collaboration, transcending geographical boundaries to advance the frontiers of applied mathematics and engineering. As we reflect on the success of this workshop, we look forward to future iterations that will further enrich our understanding and harness the power of mathematics to address complex challenges in industry and beyond.

Report on the "WORKSHOP on Mathematics for Industry 2023" conference

The "WORKSHOP on Mathematics for Industry 2023" was a significant event held during September 25-29, 2023, at Warsaw University of Technology, Poland. The workshop was organized as part of "Basis of Mathematics in nanomedicine structures and life sensing" research project aimed at fostering collaboration between academia and industry in the field of applied mathematics. This report presents an overview of the workshop, its objectives, participants, and outcomes.

Organizing Institutions: The workshop was a joint endeavor of the following institutions:

- Faculty of Mathematics and Information Science, Warsaw University of Technology,
- Center for Advanced Studies, Warsaw University of Technology,
- Institute of Mathematics for Industry, Kyushu University.

Objectives: The primary goal of the workshop was to facilitate interdisciplinary discussions and collaborations between mathematicians and applied scientists. The overarching theme focused on the integration of pure mathematical concepts into engineering applications and vice versa. By exploring the interplay between mathematics and engineering, the workshop aimed to inspire new research directions and foster innovation in both fields.

Participants: Approximately 70 participants attended the workshop, representing a diverse range of backgrounds and interests. Attendees included researchers at various career stages, students, and PhD candidates. Participants who could not attend the event on-site were given access to an online broadcast of the workshop via the MS Teams platform.

Program Overview: The workshop featured 25 individual talks and 5 mini-courses, each consisting of 3 lectures. The presentations explored the application of mathematical concepts to address real-world engineering challenges and showcased innovative research at the intersection of mathematics and industry. The talks were delivered by speakers affiliated with institutions from both Poland and Japan, facilitating cross-cultural exchange and collaboration. The topics covered during the workshop spanned a wide array of areas including:

- topological data analysis,
- medical imaging methods,
- human genome models,
- big data/machine learning,
- cryptography,
- information geometry,
- convex optimization,
- physical models of elastic/plastic bodies and fluids,
- material engineering.

Outcomes: The workshop served as a platform for fruitful discussions, knowledge exchange, and networking opportunities. It facilitated the establishment of new collaborations between academic institutions in Poland and Japan, fostering international research partnerships. Furthermore, the event inspired attendees to explore novel research directions and apply mathematical techniques to address pressing engineering problems.

Conclusion: The "WORKSHOP on Mathematics for Industry 2023" was a successful endeavor that brought together researchers and practitioners from diverse backgrounds to explore the intersection of mathematics and engineering. The event not only facilitated interdisciplinary collaboration but also contributed to the advancement of knowledge in applied mathematics and its applications in industry.

Future Directions: The project will conclude with the publication of the conference proceedings booklet containing printouts of the talks held during the workshop. Additionally, future iterations of the workshop could expand to include broader participation from international institutions and explore emerging research areas at the intersection of mathematics and industry.

List of mini-courses:

- Paweł Dłotko, *"Introduction to Topological Data Analysis"*,

- Arimura Hidetaka, *"Medical imaging signatures with topology for cancer"*,
- Shunsuke Ichiki, *"Singularity theory and its applications to strongly convex multiobjective optimization problems"*,
- Jan Mielniczuk, *"Modelling Regression Dependencies"*,
- Dariusz Plewczyński, *"Unveiling the Dynamic Nuclear Landscape: A Mini-Course on 3D Human Genome Modelling"*.

List of individual talks:

- Przemysław Biecek, *"Explanatory Model Analysis"*
- Piotr Borowik, *"How to measure unmeasurable? The case study of smells in environment protection"*
- Tomasz Cieślak, *"(In)stability of spiral vortex sheets"*
- Karol Ćwieka, *"Virtual design of nanocomposites for tunable visible-light plasmon-enhanced photocatalytic transformations"*
- Toshizumi Fukui, *"Pseudospheres from singularity theory view-point with a classification of 2-soliton surfaces"*
- Leon Gradon, *"Formation of nanostructured functional particles with the spray-drying method"*
- Przemysław Grzegorzewski, *"On comparing distributions with imprecise data"*
- Naoki Hamada, *"Brief Introduction to Topology for Multi-objective Optimization"*
- Lucía Ivonne Hernández Martínez, *"Bautin bifurcation in a minimal model of immunoediting"*
- Yuichi Ike, "*Persistent Homology and Machine Learning"*
- Stanisław Janeczko, "*Exotic shapes of nano-spherical structures - new DNA coding"*
- Paweł Józiak, *"How to measure data diversity and why is it important?"*
- Konstanty Junosza-Szaniawski, *"Cryptographic protocol verification – results of EPW project"*
- Shizuo Kaji, *"Synergies of medicine, physics, and mathematics in medical imaging"*
- Kenji Kajiwara, *"Generation of Aesthetic Shape by Integrable Geometry"*
- Konrad Kisiel, "*Plasticity - Modeling and mathematical analysis"*
- Miyuki Koiso, *"Developable surfaces with curved folds and applications"*
- Bartosz Kołodziejek, "*Learning Permutation Symmetry of a Gaussian Vector"*
- Shigeki Matsutani, *"Supercoiled structure of DNA and hyperelliptic functions"*
- Naomichi Nakajima, *"Information geometry of positive measures"*
- Mariusz Niewęgłowski, *"Multivariate Hawkes processes"*
- Takashi Nishimura, *"On envelopes created by circle families in the plane (a joint work with Yongqiao Wang)"*
- Zbigniew Peradzyński, *"Calcium waves sustained by calcium influx through mechanically activated channels in the cell membrane"*
- Osamu Saeki, *"Generalization of Reeb spaces and application to data visualization"*
- Hiroshi Teramoto, *"On constraint qualifications in multi-objective optimization problems"*

Scientific Committee:

- Tomasz Cieślak (Warsaw University of Technology),
- Wojciech Domitrz (Warsaw University of Technology),
- Leon Gradoń (Warsaw University of Technology),
- Naoki Hamada (KLab Inc.),
- Yuichi Ike (Kyushu University),
- Stanisław Janeczko (Warsaw University of Technology),
- Shizuo Kaji (Kyushu University),
- Kenji Kajiwara (Kyushu University),
- Miyuki Koiso (Kyushu University),

- Shigeki Matsutani (Kanazawa University),
- Jan Mielniczuk (Warsaw University of Technology),
- Takashi Nishimura (Yokohama National University),
- Dariusz Plewczyński (Warsaw University of Technology),
- Maria Aparecida Soares Ruas (University of São Carlos),
- Osamu Saeki (Kyushu University),
- Hiroshi Teramoto (Kansai University).

Organizing Committee: Wojciech Domitrz (WUT), Stanisław Janeczko (WUT), Osamu Saeki (Kyushu University), Marcin Zubilewicz (WUT), Michał Zwierzyński (WUT).

WORKSHOP on Mathematics for Industry 2023

Programme

Mini courses Registration

	Monday (25.09)	Tuesday (26.09)	Wednesday (27.09)	Thursday (28.09)	Friday (29.09)
8:00 – 9:00	**Registration (up to 11:00)**				
9:00 – 9:10	**Opening of the Workshop**	**8:30 – 9:00** *Lecture: Paweł Józiak*	**8:15 – 9:00** *Mini course: Shunsuke Ichiki 2*	**8:30 – 9:00** *Lecture: Piotr Borowik*	*Lecture: Kenji Kajiwara*
9:15 – 10:00	*Mini course: Jan Mielniczuk 1*	*Mini course: Jan Mielniczuk 2*	*Mini course: Dariusz Plewczyński 2*	*Mini course: Jan Mielniczuk 3*	*Mini course: Shunsuke Ichiki 3*
10:15 – 11:00	*Mini course: Shunsuke Ichiki 1*	*Mini course: Dariusz Plewczyński 1*	*Mini course: Paweł Dłotko 3*	*Mini course: Arimura Hidetaka 1*	*Mini course: Dariusz Plewczyński 3*
11:00 – 11:30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:30 – 12:15	*Mini course: Paweł Dłotko 1*	*Mini course: Paweł Dłotko 2*	*Lecture: Yuichi Ike*	*Mini course: Arimura Hidetaka 2*	*Mini course: Arimura Hidetaka 3*
12:30 – 13:00	*Lecture: Naoki Hamada*	*Lecture: Tomasz Cieślak*	*Lecture: Przemysław Grzegorzewski*	*Lecture: Shigeki Matsutani*	*Lecture: Hiroshi Teramoto*
13:00 – 15:00	Lunch	Lunch	Lunch	Lunch	Lunch
15:00 – 15:30	*Lecture: Przemysław Biecek*	*Lecture: Leon Gradoń*		*Lecture: Zbigniew Peradzyński*	*Lecture: Osamu Saeki*
15:45 – 16:15	*Lecture: Mariusz Niewęgłowski*	*Lecture: Karol Ćwieka*		*Lecture: Konrad Kisiel*	*Lecture: Naomichi Nakajima*
16:15 – 16:45	Coffee break	Coffee break		Coffee break	Coffee break
16:45 – 17:15	*Lecture: Lucía Ivonne Hernández Martínez*	*Lecture: Toshizumi Fukui*		*Lecture: Shizuo Kaji*	*Lecture: Bartosz Kołodziejek*
17:30 – 18:00	*Lecture: Stanisław Janeczko*	*Lecture: Miyuki Koiso*		*Lecture: Takashi Nishimura*	*Lecture: Konstanty Junosza-Szaniawski*
18:00 – 22:00	**Dinner @ MaIS Faculty**			**Dinner @ MaIS Faculty**	