University *of Ljubljana*
Faculty *of Mechanical Engineering*

Annual Report

2022

University *of Ljubljana*
Faculty *of Mechanical Engineering*

University of Ljubljana

Faculty of Mechanical Engineering

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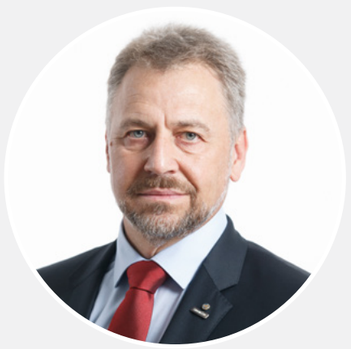
FACULTY MANAGEMENT



Dean
Prof. Mihael Sekavčnik, PhD

Vice Dean for Education, 1st Cycle
Prof. Franci Pušavec, PhD

Vice Dean for Education, 2nd and 3rd Cycles
Prof. Jernej Klemenc, PhD

Secretary
Tone Češnovar, PhD

Vice Dean for Research and International Relations
Prof. Janko Slavič, PhD

SUPPORTING SERVICES

Faculty secretariat	Andreja Koban Domitrovič
Student office	Nika Vardjan Naglič
Accounts and financial department	Barbara Bergant Kaučič, MSc
Human resource department	Anja Novak
Department of international cooperation, scientific and research work	Tanja Mavrič Rušt, MSc
Department of Economic Affairs and Communications	Katja Pustovrh
Library	Zorka Kešelj
Technical and maintenance department	Vinko Tomc
IT department	Vida Trček
Publishing department	Pika Škraba, MSc, Roman Putrih

FOLLOWING THE CHOSEN PATH

The Faculty of Mechanical Engineering (FME) is successfully following the path it outlined in the 2019-2025 Development Strategy. The reputation of the faculty is growing in society and the economy, with its results making the faculty the leading scientific educational and professional institution in the field of mechanical engineering in the region, and a valued partner in large international research consortia and business partnerships. We have been recognized as an example of successful development for every member of the University of Ljubljana, and have been valued in many areas as highly penetrating, innovative and ambitious. As a result, the management of the Faculty of Mechanical Engineering has been invited several times by the Rectorate and other members of the University of Ljubljana to present individual solutions and their implementation as an example of good practices in the areas of pedagogical work, digitization, habilitation and organizational structure.

We are successfully introducing digitalization in the learning process at the faculty. This is also stipulated in the renewed study programme, which introduces a very high degree of optionality, which enables students to create personalized schedule by using the Studo online application. Using our experience in implementing the renewed study process, we upgraded and developed the schedules so that students can make the most of the optionality with minimum overlapping of contact hours. Digitalization of study content was also initiated as part of the renewal of higher education study programmes, which is additionally financed by the Reconstruction and Resilience Plan (RRP). In the application of projects within the ULTRA (UL) programme, we manage two pilot projects: digital and sustainable society oriented mechanical engineering study programme and Open Laboratory for multidisciplinary and intercultural creativity with a total value of EUR 2.1 million. Within the framework of the aforementioned pilot projects, in the first phase we will digitize at least 6 courses in professional higher education, we will introduce 6 technology demonstrators, where students will get direct user experience in the independent implementation of laboratory exercises, and 6 professional training courses will also be prepared for lifelong education in micro evidence system.

The open laboratory, which was named Peskovnik, came to life nicely. It actively involves 44 members, who implement their technical ideas and also strengthen the values of the open laboratory, connect into the community of students from the entire UL, exchange knowledge and skills and implement their ideas in group and individual projects. Honourable mentions among the completed projects include: Development of a high-speed 3D printer, Prototype of a vertical aircraft for the future of mobility, Establishment of an environment for open innovation within the open laboratory, and more. Students from nine UL members organized 42 workshops. Among team projects, the Edvard Rusjan Slovenian Team traditionally stands out, achieving high-profile international results.

Photo: Željko Stevanić, IFP d.o.o.

The realization of the strategic goals we set in the FME Strategy in the field of creating joint research platforms in four focus areas led to the strengthening of inter-laboratory cooperation and joint performance in the preparation of research project applications, as well as cooperation in development market projects. Encouraging beginnings tell us that the direction we are taking is right and that together we are stronger in finding better opportunities for the development of the Faculty of Mechanical Engineering.

The high profile and visibility of the faculty is also expanding among the general public, which is the result of systematic and long-term oriented efforts to promote a) excellent results in all areas of the faculty's activities, and b) targeted activities for the popularization of engineering in the field of mechanical engineering. The thanks for exemplary cooperation goes to the management, joint services and heads of laboratories.

The scope of research activity is increasing with a growing trend, as evidenced by the following data:

I. 12 million Euros in revenue from research and development activities,
II. 3,3 million Euros of investments in research equipment, ongoing maintenance and new construction,
III. 19 successful applications in ARRS research projects,
IV. successful applications of international research projects,
V. 230 original scientific articles,
VI. 10% more clean citations per WoS database,
VII. 11 prizes awarded for outstanding publications to colleagues under 35 years of age.

The common denominator of the timely preparation of projects for new constructions (PZI – detailed design, OPPN – municipal detailed spatial plan) and in particular the funding from the European Commission is again the selfless cooperation of the entire team and the unwavering determination, sacrifice and persuasiveness of the management of the faculty and of its building committee. Result: in October 2022, the Government of the Republic of Slovenia and the European Commission on Cohesion Policy 2021-2027 signed an agreement, which provided us with EUR 80 million, which enables the start of the construction of the new Faculty of Mechanical Engineering! At the same time, we received congratulations from representatives of the Government of the Republic of Slovenia (Ministry of Education, Science and Sport; Government Office of RS for Development and European Cohesion Policy, etc.) as well as economic operators (Chamber of Commerce and Industry of Slovenia, Strategic Research and Innovation Partnerships, etc.), who recognized our determination, perseverance, professionalism and, last but not least, ingenuity in managing new construction project. The same stakeholders have also always acknowledged our top results in the field of research work, international involvement, cooperation with economic operators and the suitability of future development activities.

Photo: Sadar+Vuga

The above-mentioned facts show that we are reaping abundant fruit of hard work. Of course, this does not mean that the task is easy; we are in a transition period practically at all levels of the faculty's operations: the completion of the transition to the renewed study program, APIS, RRP projects, changed way of financing UL/FME, the upcoming reforms of ministries and the Slovenian Research Agency and, of course, new construction.

The encouraging results of our joint efforts strengthen our awareness that we are doing good and for the good of the whole society. That is why I am all the more convinced that the ever more demanding challenges the future holds for us will place us alongside the most developed economies and societies, thanks to the new knowledge, original ideas, solutions and innovations that we create at the Faculty of Mechanical Engineering of UL.

Dean of the Faculty of Mechanical Engineering

Prof. dr. Mihael Sekavčnik

INTRODUCTION

UNIVERSITY OF LJUBLJANA

University of Ljubljana is the oldest and largest higher education and scientific research institution in Slovenia. University with its rich tradition was founded in 1919. It has approximately 40,000 undergraduate and postgraduate students and employs approximately 6,000 higher education teachers, researchers, assistants and administrative staff in 23 faculties and three arts academies. The central building, all three academies and faculties are located in the centre. Some of the most recent and modern buildings were constructed on the outskirts of Ljubljana, giving the university and its students a ubiquitous presence in the city.

The University of Ljubljana is renowned for its quality social and natural sciences and technical study programmes, structured in accordance with the Bologna Declaration. Our projects keep pace with the latest developments in the areas of arts, sciences and technology at home and abroad.

The University of Ljubljana has been ranked among the top 500 universities by the prestigious Academic Ranking of World Universities (ARWU); it is placed 416th in The Center for World University Rankings (CWUR), listed in the 801-1000 group in the Times Higher Education (THE) ranking, and the 591-600 group in the Quacquarelli Symonds ranking.

The University of Ljubljana is the central and largest educational institution in Slovenia. It is also the central and largest research institution in Slovenia with 30 percent of all registered researchers (according to the data from the SICRIS database).

The University takes a central pedagogical position by performing public services in the areas of special social importance which ensure the preservation of the national identity.

The University of Ljubljana has close ties with Slovenian companies and foreign enterprises. Our partners include multinational corporations and the most successful Slovenian companies. As we are fully aware of the importance of knowledge and skills in obtaining our own financial sources, we are increasingly developing our market oriented activities every year.

FACULTY OF MECHANICAL ENGINEERING, UNIVERSITY OF LJUBLJANA

The Faculty of Mechanical Engineering is a member of the University of Ljubljana, and an important educational and research institution with high international standards in the field of mechanical engineering in Slovenia and the wider region of the Central and Southeast Europe. Through the history and with development the faculty overcame the classic understanding of mechanical engineering, since today it offers programmes from numerous specialised engineering fields.

Foundation

Throughout history, technical occupations were well established among the Slovenes, although until the establishment of the University in Ljubljana in 1919, students had to attain their knowledge abroad, mostly in the Austrian universities. After the end of the World War 1, which also meant the end of the Austro-Hungarian rule, the wish to establish our own university, which would include a faculty of technical sciences also came to life. Even before the formal establishment of the University of Ljubljana there were organised lectures for the students of mechanical, electrical and civil engineering. The Faculty of Technical Sciences in Ljubljana was established through the effort by Milan Vidmar, PhD, and it remained in such form until 1957, when the departments of electrical and mechanical engineering were united. In October 1960, under the resolution of the University Board, the Faculty of Mechanical Engineering became an independent member of the University of Ljubljana with study programmes on all three levels. In the beginning it had four chairs – organisational units – where the faculty and assistants performed teaching and scientific work. The faculty was at first housed in the so called old building on Aškerčeva cesta 6; in 1971 it moved into a new building at the same location. Today, the Faculty of Mechanical Engineering of the University of Ljubljana is still located in both buildings.

Today

The Faculty of Mechanical Engineering of the University of Ljubljana is today the largest institution for education and research of mechanical engineering in Slovenia. In-house design and research work, and quality transfer of knowledge to the students and research partners enables a competitive integration into the international environment.

The Faculty of Mechanical Engineering carries out its **educational activities** for all three study cycles in accordance with the Bologna Declaration guidelines. Two first cycle study programmes, the professional and academic programmes, deliver an insight into a wider field of mechanical engineering; the second cycle master's programme is a continuation of the first cycle; the individually tailored third cycle doctoral programme is based on solving problems at the highest scientific level. The educational process in the first and second cycles is carried out in the form of lectures and practicals, where the lectures provide theoretical knowledge, and the laboratories perfect practical skills. The degree, obtained at the Faculty of Mechanical Engineering, is internationally accredited on the European level (ASIIN, ENUA, EUR-ACE), and is equal to other degrees in Europe.

Scientific research work at the Faculty of Mechanical Engineering is carried out in the fields of power and process engineering, design, mechanics and maintenance of machines, production engineering, mechatronics, micromechanic systems and automatisation. The researchers are involved in national basic and applicative projects, and in numerous international projects, actively working with scientific research centres and the industry. Through cooperation with the industry and other institutions the faculty is contributing toward higher economic growth, and is publishing the results of innovation potentials in international scientific journals. Special attention is also given to the education of young and promising researchers, who decide on the career path in research also because of the tenders from ARRS (Slovenian Research Agency).

CHAIRS AND LABORATORIES AT THE FACULTY OF MECHANICAL ENGINEERING

The Faculty of Mechanical Engineering has been broken into units called chairs since the very start of its independent operations. The organisational structure derives from the basic courses, which further spread and evolved into specific areas or subunits called laboratories with the development of research engineering.

In 2022, 33 laboratories and a Unit for Supplementary Division operated within the scope of 16 chairs.

CHAIR OF SYNERGETICS

Laboratory for Synergetics LASIN

1

CHAIR OF MACHINE ELEMENTS AND DEVELOPMENT EVALUATION

Laboratory for Machine Elements LASEM

Laboratory for Structure Evaluation LAVEK

2

CHAIR OF POWER ENGINEERING

Laboratory for Internal Combustion Engines and Electromobility LICeM

Laboratory for Heat and Power LTE

Laboratory for Hydraulic Machines LVTS

Laboratory for Pumps, Compressors and Technical Acoustics LEDSTA

3

CHAIR OF OPTODYNAMICS AND LASER APPLICATIONS

Laboratory for photonics and laser systems FOLAS

Laboratory for laser techniques LASTEH

10

CHAIR OF TRIBOLOGY AND MAINTENANCE SYSTEMS

Laboratory for tribology and interface nanotechnology TINT

Laboratory for Fluid Power and Controls LFT

11

CHAIR OF FLUID DYNAMICS AND THERMODYNAMICS

Laboratory for Fluid Dynamics and Thermodynamics LFDT

12

CHAIR OF CYBERNETICS, MECHATRONIC AND PRODUCTION ENGINEERING

Laboratory for Mechatronics, Production Systems and Automation LAMPA

4

CHAIR OF MANUFACTURING TECHNOLOGIES AND SYSTEMS

Laboratory for Forming LAP

Laboratory for Alternative Technologies LAT

Laboratory for Handling, Assembly and Pneumatics LASIM

5

CHAIR OF MATERIALS, SCIENCE AND TECHNOLOGY

Laboratory for heat treatment and materials testing LATOP

Laboratory for Welding LAVAR

6

CHAIR OF THERMAL AND ENVIRONMENTAL ENGINEERING

Laboratory for Heating, Sanitary, Solar and Air Conditioning Engineering LOSK

Laboratory for Refrigeration and District Energy LAHDE

Laboratory for Sustainable Technologies in Buildings LOTZ

13

CHAIR OF MACHINING TECHNOLOGY MANAGEMENT

Laboratory for Cutting LABOD

Laboratory of Quality Assurance LAZAK

14

CHAIR OF ENGINEERING DESIGN AND TRANSPORTATION SYSTEMS

Laboratory for Engineering Design LECAD

Laboratory for Material Handling and Machine Structures LASOK

15

CHAIR OF HEATING AND PROCESS ENGINEERING

Laboratory for Measurements in Process Engineering LMPS

Laboratory for Heating Technology LTT

7

CHAIR OF MECHANICS

Laboratory for Non-Linear Mechanics LANEM

Laboratory for Numerical Modelling and Simulation LNMS

Laboratory for Dynamics of Machines and Structures LADISK

8

CHAIR OF MECHANICS OF POLYMERS AND COMPOSITES

Laboratory for Experimental Mechanics LEM

9

CHAIR OF MODELLING IN ENGINEERING SCIENCES AND MEDICINE

Laboratory for Modelling Machine Elements and Structures LAMEK

Traffic Accident Analysis and Research Laboratory LAPN

16

AVIATION DIVISON

Laboratory for aeronautics AEROL

17

UNIT FOR SUPPLEMENTARY DIVISION

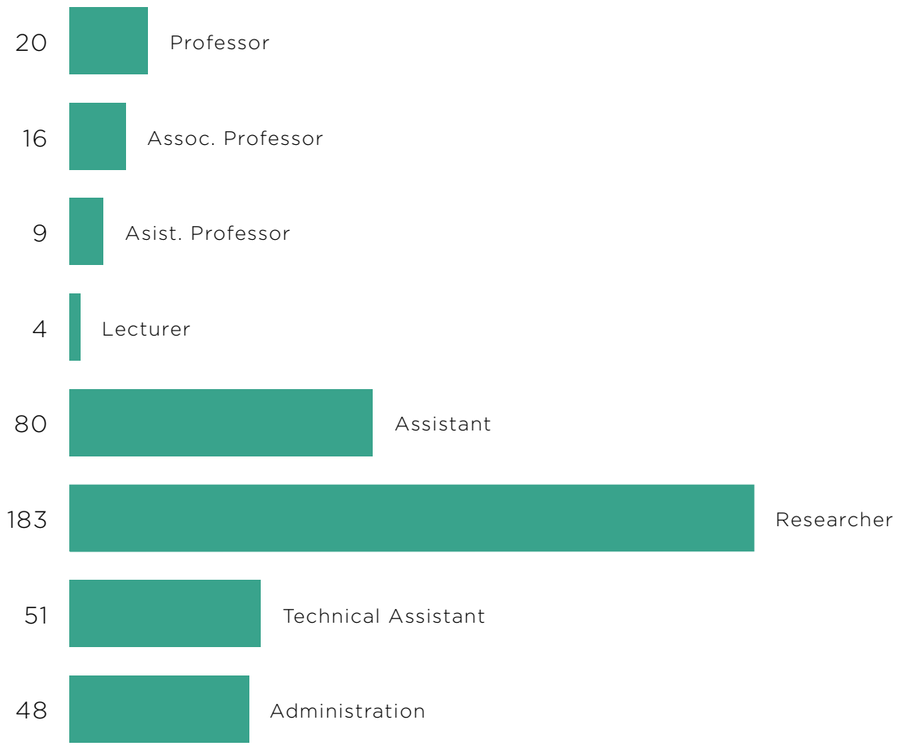
Mathematics Research Team RSMAT

Unit for Supplementary Division EDZ

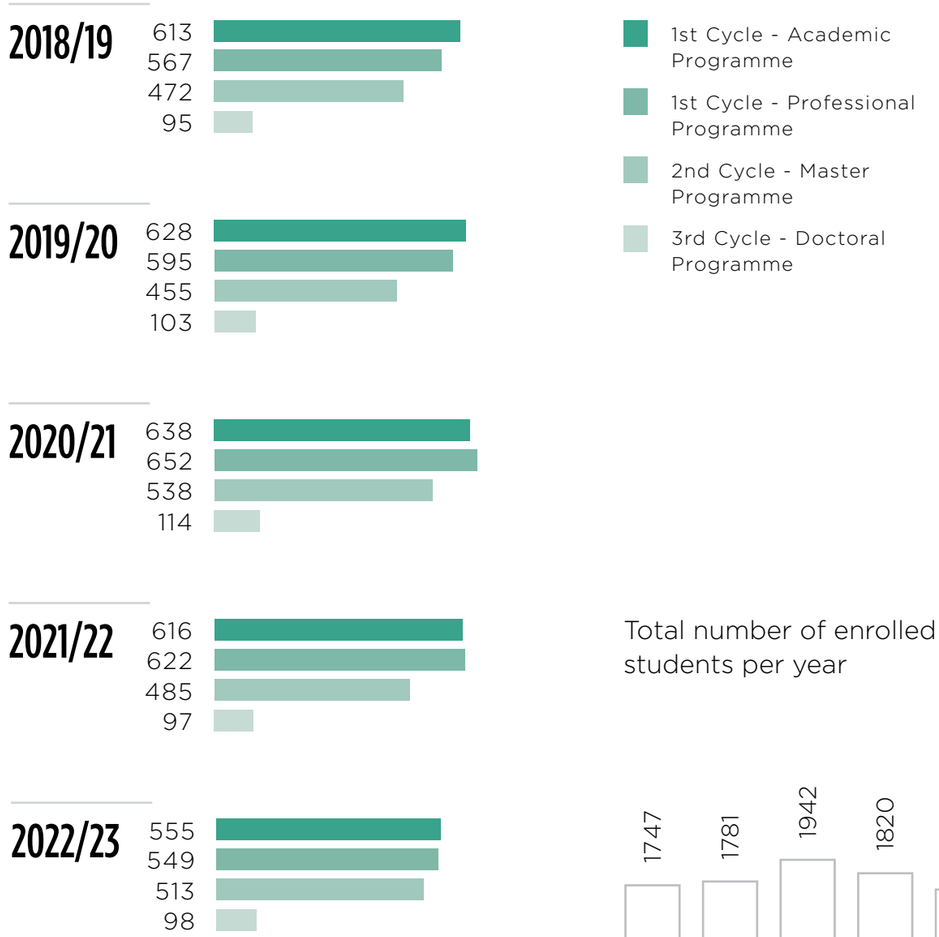
18

THE FACULTY OF MECHANICAL ENGINEERING IN NUMBERS

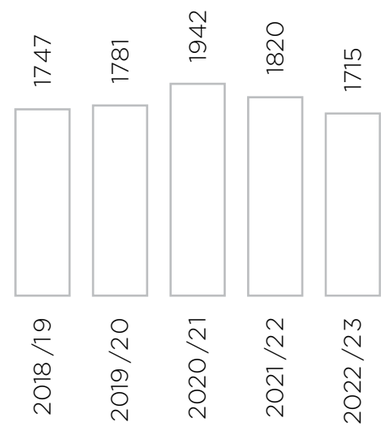
EMPLOYEE STRUCTURE



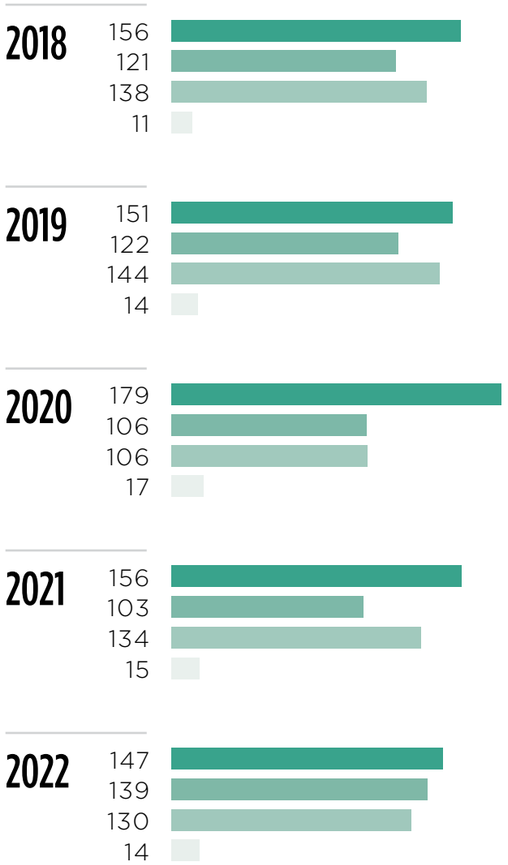
NUMBER OF ENROLLED STUDENTS

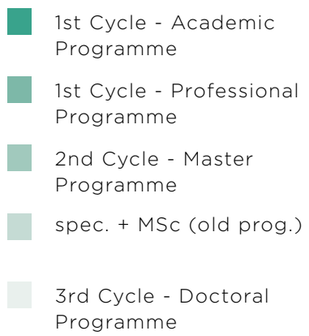


Total number of enrolled students per year

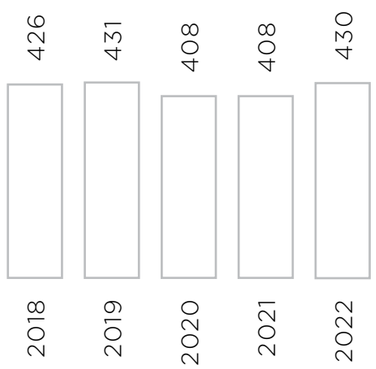


NUMBER OF GRADUATES





Total number of graduates per year



FINANCING STRUCTURE IN %

NUMBER OF INTERNATIONAL RESEARCH PROJECTS

Programm	2018	2019	2020	2021	2022
Obzorje Evropa	0	0	0	0	**8**
Horizon 2020	11	11	12	12	**13**
ERDF - European regional develoment fond	9	10	4	2	**0**
ERA-NET M-era.Net	1	1	1	0	**2**
Life+	1	1	1	1	**1**
Erasmus +	6	9	8	9	**13**
European Defence Fund (EDF)	0	0	0	0	**2**
European defence agency (EDA)	0	1	1	1	**1**
European space agency (ESA)	1	1	0	0	**1**
Eureka	1	1	1	1	**1**
EIT – European Institute od Innoavation & Technology	2	2	2	3	**2**
COST	8	8	7	7	**6**
Other	5	5	7	9	**16**
Total	**45**	**50**	**44**	**45**	**66**

NUMBER OF MARKET-ORIENTED PROJECTS WITH THE INDUSTRY

NUMBER OF ORIGINAL SCIENTIFIC ARTICLES

NUMBER OF PATENTS

PUBLISHING AND JOURNALS

PUBLISHING

The publishing department of the Faculty of Mechanical Engineering is publishing study materials and other non-periodicals. The department is following the rules, set out by the Senate of the faculty, which define the main framework of its activities. The publishing department publishes 25 publications per year with an international standard book number (ISBN) and CIP, the acronym for the cataloguing in publication. The publishing department began using the ISBN system in 1986; since then it published almost 340 works with the ISBN number. These are course books, proceedings of domestic and international conferences, organised by chairs and laboratories of the faculty, printed editions of doctoral works, and scientific monographs. In the recent years the publications are also available in electronic form on CDs and USB sticks; free course books are available at the faculty website and the Repository of the University of Ljubljana.

With the introduction of digital printing technology the process for printing publications is significantly shorter and also much cheaper. Digital printing technology provides quality and relatively low cost printing also for limited editions. Due to this new technology the policy of the publishing department is to sell the entire edition of a textbook in three years; after this it gets reprinted with any possible revisions and updates. The editions for the first year programmes have up to 400 copies; and up to 150 copies for higher year programmes and the second cycle. The publishing department tries to offer the textbooks at an affordable price for students; around €10 for the first year textbooks, and around €15 for higher years. In order for the textbooks to be available at the student friendly prices, the authors usually charge no fees for the first editions. Only after a reprint, when there is no cost of reviews, proofreading, and design, the authors get some compensation.

JOURNALS

Strojniški vestnik – Journal of Mechanical Engineering

The scientific international journal publishes original and (mini)review articles covering the concepts of materials science, mechanics, kinematics, thermodynamics, energy and environment, mechatronics and robotics, fluid mechanics, tribology, cybernetics, industrial engineering and structural analysis. The journal follows new trends and progress proven practice

in the mechanical engineering and also in the closely related sciences as are electrical, civil and process engineering, medicine, microbiology, ecology, agriculture, transport systems, aviation, and others, thus creating a unique forum for interdisciplinary or multidisciplinary dialogue. The international conferences selected papers are welcome for publishing as a special issue of SV-JME with invited co-editor(s). The Journal is indexed in the WoS Thomson and Scopus databases where is positioned in the fourth and third quarter, respectively. The growth of the Journal is evident in the constant increase in the number of citations in WoS.

The SV-JME has been published since 1955; the publishers are the Faculty of Mechanical Engineering of the University of Ljubljana, the Faculty of Mechanical Engineering of the University of Maribor, the Association of Mechanical Engineers of Slovenia, and the Chamber of Commerce and Industry of Slovenia.

The Journal is freely available at https://www.sv-jme.eu/issues/volume-68-2022/

Ventil

The scientific and professional journal Ventil publishes articles, dealing with the development and research work at universities, institutes and companies from the field of fluid technics, automatisation and mechatronics. Its aim is to familiarise with the achievements of Slovene companies, their products, and events, which are connected with the development and production in the relevant fields. It creates new connections between the Slovene industry and the research and development sphere, and among the Slovene and world production, developmental and expert community. It also encourages popularity of fluid technics, automatisation, and mechatronics, especially among the young people, while it also cultivates the scientific terminology in these fields.

The publishers are the University of Ljubljana, the Faculty of Mechanical Engineering with co-founders GZS-ZKI-FT (Chamber of Commerce and Industry of Slovenia, Chemical Industries Association) and SDFT (Slovene Fluid Technics Association). It has 6 issues per volume in single issues at 1,000 copies each. The technical quality conforms to the international standards, valid in Slovenia. It is also included in the COBBIS, INSPEC and university and library databases (RWTH Aachen – IFAS, TU – Wien, University in Hannover and The British Library). Under its present title Ventil the journal has been published since 1995.

The magazine is freely available at http://www.revija-ventil.si.

STUDY PROGRAMMES

The Faculty of Mechanical Engineering of the University of Ljubljana offers study programmes for all three levels since 1960, which testifies to the strong foundations of its study programmes in Slovenia. Through the years the programmes were adapted to various requirements, changed in accordance with legislation and regulations, and were thoroughly renewed in accordance with the Bologna Declaration.

Today, the Faculty of Mechanical Engineering offers the following study programmes:

1ST CYCLE

Professional Study Programme in Mechanical Engineering – Project and Applicative Programme lasts 3 years and is practice oriented; in the 2nd year it is separated into 5 basic study directions. The graduates acquire the degree of Bachelor of Applied Science in Mechanical Engineering (graduate's professional degree).

1st year	2nd year – directions
Common curriculum	**Energy engineering**
	Process engineering
	Design of machines and devices
	Design of industrial systems
	Production technologies
	Production engineering
	Airline transport pilot
	Aircraft design and maintenance
	Mechatronics

Academic Study Programme in Mechanical Engineering – Research and Development Program lasts 3 years and has no directions. Students acquire theoretical knowledge for continuation of the studies in the 2nd Cycle. Graduates acquire the degree of Bachelor of Science in Mechanical Engineering.

2ND CYCLE

Master's Study Programme in Mechanical Engineering – Development Research Program lasts 2 years and is divided into 6 basic directions. Graduates acquire the degree of Master of Engineering.

Basic directions
Engineering design
Mechanics
Energy engineering
Process engineering
Production engineering
Mechatronics and laser technology

TRIBOS – Joint Master's Programme in Tribology of Surfaces and Interfaces lasts 2 years and is carried out by four partner European universities. Graduates acquire the degree of Master of Tribology of Surfaces and Interfaces.

3RD CYCLE

Doctoral Study Programme in Mechanical Engineering lasts 4 years and is divided into three basic fields of study. Graduates acquire the degree of Doctor of Science.

Fields
Machine Design and Mechanics Engineering Science
Power and Process Engineering Science
Production Engineering Sciences, Cybernetics and Mechatronics

Interdisciplinary Doctoral Programme in Environmental Protection (coordinated at the level of the University of Ljubljana) lasts 4 years and combines the scientific fields of 13 faculties. Graduates acquire the degree of Doctor of Science.

Interdisciplinary Doctoral Study Programme Biosciences lasts 4 years and is carried out by four members of the University of Ljubljana. Graduates acquire the degree of Doctor of Science.

RESEARCH

The Faculty of Mechanical Engineering of the University of Ljubljana is carrying out its social agenda in the scientific research and applicative developmental fields in order to provide high level of excellence, and to transfer new research findings into the industrial environment.

Research and development activities at the Faculty of Mechanical Engineering include:

- Power and process engineering,
- Design,
- Engine mechanics and maintenance,
- Production engineering,
- Mechatronics,
- Micromechanical systems,
- Automatisation.

The research activities are carried out within the laboratories. The faculty is closely linked with institutes, domestic and foreign companies, and with other organisations from the field of medicine, electrical engineering, chemistry, informational technology and civil engineering. It is venturing outside the boundaries of classic research engineering, since it is reaching into new research fields, which bring higher added value to the society.

Research work is the basis for modern and quality teaching

Our researchers strongly believe that research work is the basis for progressive and quality teaching, therefore taking part in national basic and applicative projects and international projects is a regular practice at the faculty.

Development of young and promising researchers

The faculty pays special attention to the education and development of young and promising students, who are deciding on the career in research through the programme of the Slovenian Research Agency.

The Infrastructure centre for modern engineering

Within the Network of infrastructure centres of the University of Ljubljana (MRIC UL) the faculty has the Infrastructure centre for modern engineering, which offers quality operations, infrastructural support, know-how and cooperation between research groups within research institutions, the Slovene industry and the wider international arena. The Centre uses high-end equipment, which requires highly qualified and specialised staff for its operation and maintenance.

Highly trained staff, wide networks of researchers and interdisciplinary approach make the Faculty of Mechanical Engineering the largest scientific research institution in mechanical engineering in Slovenia.

Program groups

Within the Slovene Research Agency there are programme groups, which represent research fields established for a longer time period, and are important for Slovenia. The researchers from the Faculty of Mechanical Engineering are involved in the following 14 programme groups:

1. Modelling in technics and medicine
2. Multiphase systems
3. Energy engineering
4. Development evaluation
5. Heat and mass transfer
6. Tribology
7. Synergetics of complex systems and processes
8. Innovative production systems and processes
9. Engineering design
10. Mechanics in Engineering
11. Sustainable Polymer Materials and Technologies
12. Advanced Manufacturing Technologies for High Quality and Sustainable Production
13. Production systems, laser technologies and materials welding - PLAS
14. Optodynamics

PRESENTATION OF PROGRAMME GROUPS AND ACTIVITIES OF LABORATORIES

01 MODELLING IN TECHNICS AND MEDICINE

The Modelling in Engineering Sciences and Medicine programme group is based on an interdisciplinary approach and consists of researchers from the Faculty of Mechanical Engineering and the Faculty of Medicine (both University of Ljubljana).

The group's main research activity is modelling of systems related to traffic which involve modelling of mechanical and anatomical structures for investigating systems response to different kinds of excitation. Integrated into commercial software packages and expandable, these developed material and mechanical models are used for predicting the initiation and growth behaviour of damage to metallic and non-metallic materials at diverse monotonic and dynamic loads.

This enables modelling of various types of mechanical and biomechanical systems (human body, vehicles, traffic devices). The group also investigates and updates data and their relationships in traffic databases and develops geoinformation systems designed to determine exposure to traffic accident risk on specific sections of the road network.

Photo: Željko Stevanić, IFP d.o.o.

Laboratory for Modelling Machine Elements and Structures LAMEK

RESEARCH AREAS

•Technical Product Documentation (TPD) • Geometric Product Specifications (GPS) • Geometric dimensioning and tolerancing (GDT) • Mechanics of structures and machines • Structures, machine elements and materials modelling • Composite and SMA structures • Development and design of machines and production systems • Blast and ballistic response of structures • Vehicle engineering and transportation research • Traffic safety and accident analysis • Biomechanics

DEPARTMENT HEAD Assoc. Prof. Robert Kunc, PhD

DEPARTMENT MEMBERS Assist. Prof. Miha Ambrož, PhD, Assist. Prof. Simon Krašna, PhD Assist. Prof. Jovan Trajkovski, PhD, Assist. Prof. Samo Zupan PhD PhD, Assist. Prof. Andrej Žerovnik, PhD, Asist. Matej Kranjec, PhD, Assist. Aleksander Novak, Slobodanka Ivanjić Kostrešević, Jernej Korinšek, Assist. Luka Roblek, Assist. Narendra Singh, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

GLJUŠĆIĆ, Matej, FRANULOVIĆ, Marina, LANC, Domagoj, ŽEROVNIK, Andrej. Representative volume element for microscale analysis of additively manufactured composites. Additive manufacturing, ISSN 2214-8604. [Print ed.], Aug. 2022, vol. 56, str. 1-13.

Photo: Željko Stevanić, IFP d.o.o.

NEBOT-ANDRÉS, Laura, DEL DUCA, Manuel Gesù, APREA, Ciro, ŽEROVNIK, Andrej, TUŠEK, Jaka, LLOPIS, Rodrigo, MAIORINO, Angelo. Improving efficiency of transcritical CO2 cycles through a magnetic refrigeration subcooling system. Energy conversion and management, ISSN 0196-8904. [Print ed.], Aug. 2022, vol. 265, str. 1-14.

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KOPYLOV, Semen, PHANOMCHOENG, Gridsada, AMBROŽ, Miha, PETAN, Žiga, KUNC, Robert, QIU, Yi. Improvements to a vehicle%s ride comfort by controlling the vertical component of the driving force based on in-wheel motors. Journal of vibration and control : JVC, ISSN 1077-5463. [Tiskana izd.], 2022, str. 1-14.

KUŠAR, Maša, DJOKIĆ, Mihajlo, DJORDJEVIĆ, Srdjan, HRIBERNIK, Marija, KRAŠNA, Simon, TROTOVŠEK, Blaž. Preliminary study of reliability of transcutaneous sensors in measuring intraabdominal pressure. Scientific reports, ISSN 2045-2322, 2022, vol. 12, str. 1-11.

PROJECTS

Horizon 2020 - VIRTUAL - Open access virtual testing protocols for enhanced road users safety. Simon Krašna. 01.06.2018 - 31.05.2022

Company SMM – Research work. Robert Kunc. Ongoing since 1.1.2016

Slovenian Research Agency, Ministry of Defence. Road traffic safety - Development of new road traffic safety assessment methodology. Robert Kunc. 01.10.2022 - 30.09.2024

UNIVERSITY, HIGER EDUCATION OR SHORT-TERM HIGER EDUCATION TEXTBOOK WITH REVIEW

AMBROŽ, Miha (avtor, ilustrator). Logistika prometa. 2., dopolnjena izd. Ljubljana: Fakulteta za strojništvo, 2022.

02 MULTIPHASE SYSTEMS

The program group Multiphase systems (2022-2027) is focused on the following highly interconnected research and development activities, encompassing the whole spectra of technology readiness levels:

1. Computational and experimental investigation of an extended-spectrum of coupled multiphase, multiscale and multiphysics problems with solids, fluids, and gasses. Key accents on multiphase flows, melting and solidification.

2. Investigation of the influence of external fields (rotation, shaking, magnetohydrodynamics, ultrasonics) on multiphase systems.

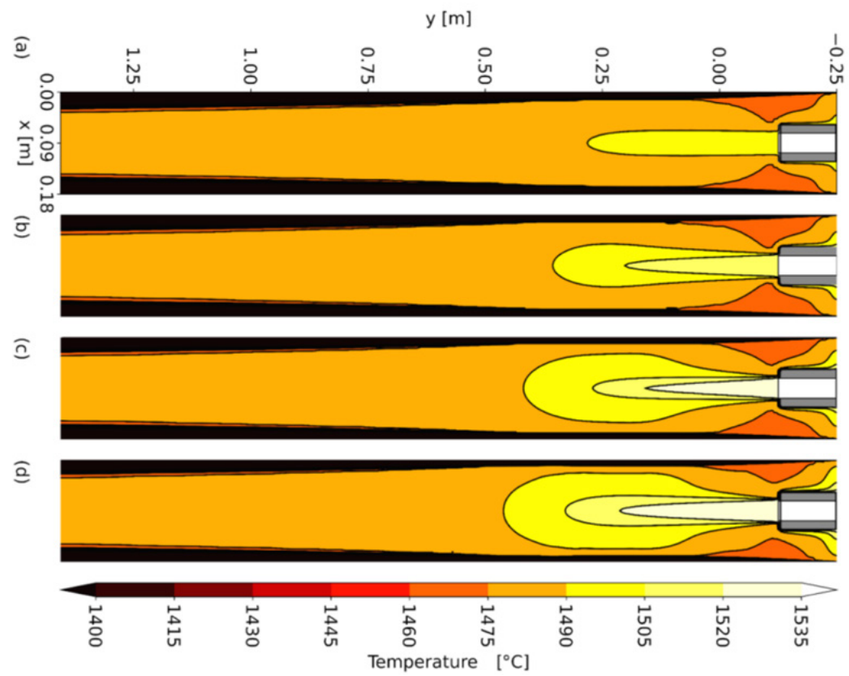
3. Development of a new generation of highly efficient and self-adaptive meshless methods for problems of classical field theories.

4. Horizontal integrated materials modelling for through process simulations; development of artificial intelligence and physical models of manufacturing and materials processing chains; in particular for casting, rolling, extrusion and heat treatment.

5. Vertical integrated materials modelling for multiscale simulations; relations between process parameters - macrostructure - microstructure - properties.

6. Vital connection of the developments with the high-end Slovenian and global industry concerning digitalization, quality, productivity, safety and environmental impact.

7. Design of novel microfluidic sample delivery systems for femtosecond crystallography used in large international research centres with free-electron lasers and synchrotrons.



Three-dimensional meshless simulation of continuous casting of steel with large eddy turbulence model at different withdrawal speeds.

Laboratory for Fluid Dynamics and Thermodynamics LFDT

RESEARCH AREAS

• Two-phase flow • Microfluidics • Solidification • Meshless methods • Multiscale and multiphysics modelling • Modelling of materials and processes • Intelligent systems

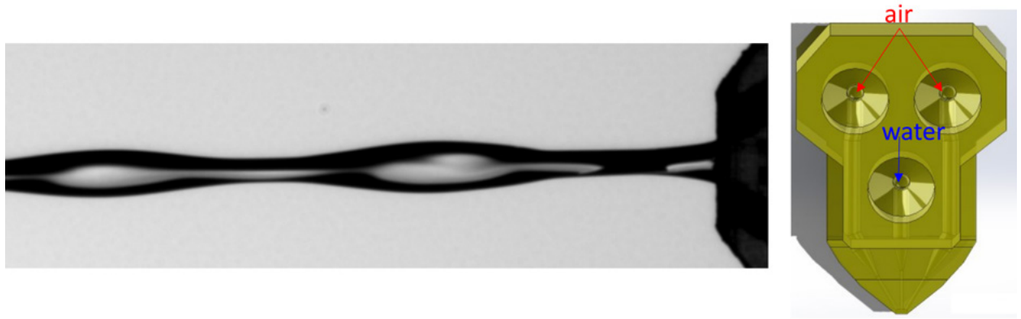
DEPARTMENT HEAD Prof. Božidar Šarler, PhD

DEPARTMENT MEMBERS Assist. Prof. Anton Bergant, PhD, Assist. Prof. Andrej Bombač, PhD, Assist. Prof. Matjaž Perpar, PhD, Assist. Boštjan Mavrič, PhD, Assist. Jurij Gregorc, PhD, Assist. Zahoor Rizwan, PhD, Assist. Vanja Hatić, PhD, Res. Assoc. Zlatko Rek, PhD, Assist. Umut Hanoglu, PhD, Assist. Katarina Mramor, PhD, Res. Assoc. Miha Kovačič, PhD, Res. Assoc. Robert Vertnik, PhD, Assist. Qingguo Liu, PhD, Belšak Grega, Matic Cotič, Assist. Rana Khush Bakhat, Assist. Gašper Vuga, Assist. Ajda Kunavar, Assist. Tadej Dobravec, PhD, Assist. Izaz Ali, Assist. Abdolahzadeh Mohsen, Assist. Kovačič Krištof, Zdenka Rupič

ORIGINAL SCIENTIFIC ARTICLES

KOVAČIČ, Miha, ŽUPERL, Uroš, BREZOČNIK, Miran. Optimization of the rhomboidity of continuously cast billets using linear regression and genetic programming: A real industrial study. Advances in production engineering & management, ISSN 1854-6250, Dec. 2022, vol. 17, no. 4, str. 469-478.

DOBRAVEC, Tadej, MAVRIČ, Boštjan, ŠARLER, Božidar. Acceleration of RBF-FD meshless phase-field modelling of dendritic solidification by space-time adaptive approach. Computers & mathematics with applications, ISSN 1873-7668, Nov. 2022, vol. 126, str. 77-99, ilustr.



Left: liquid sheet. Right: micro-nozzle for generation of liquid sheets.

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ŽUPERL, Uroš, KOVAČIČ, Miha, BREZOČNIK, Miran. An anfis-mechanistic simulator of tool loads in ball-end milling of layered metal materials. International journal of simulation modelling, ISSN 1726-4529, Dec. 2022, vol. 21, no. 4, str. 639-650.

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URBANOWICZ, Kamil, BERGANT, Anton, GRZEJDA, Rafał, STOSIAK, Michal. About inverse Laplace transform of a dynamic viscosity function. Materials, ISSN 1996-1944, Jun. 2022, vol. 15, iss. 12, str. 1-26, ilustr.

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KOVAČIČ, Miha, ŽUPERL, Uroš. Modeling of tensile test results for low alloy steels by linear regression and genetic programming taking into account the non-metallic inclusions. Metals, ISSN 2075-4701, Aug. 2022, vol. 12, iss. 8 (1343), str. 1-17.

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PROJECTS

Slovenian Research Agency. Advanced meshless modelling and simulation of multiphase systems. Božidar Šarler. 1.7.2019 – 30.6.2022

Slovenian Research Agency. Modelling for thermal control of Plasma Facing Components (PFCs) in fusion reactors. Božidar Šarler. 1.3.2020 - 28.2.2022

Slovenian Research Agency. Development of innovative meshless methods for multiphysics and multiscale simulation of cutting-edge technologies. Božidar Šarler. 01.10.2022 - 30.09.2025

Slovenian Research Agency. Advanced meshless modelling and simulation of microstructure evolution for the top-quality metal products. Tadej Dobravec. 01.10.2022 - 30.09.2024

DESY Hamburg - Innovative methods for imaging with the use of x-ray free electron laser and synchrotron sources - II. Božidar Šarler. 13.4.2018 - 12.4.2022

DESY Hamburg - Innovative methods for imaging with the use of x-ray free electron laser and synchrotron sources - III. Božidar Šarler. 13.4.2022 - 12.4.2026

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DOCTORAL DISSERTATION

BELŠAK, Grega. Numerical simulations of nozzles with gas and liquid focusing for production of micro-jets : dissertation. Mentor: Božidar Šarler

03 ENERGY ENGINEERING

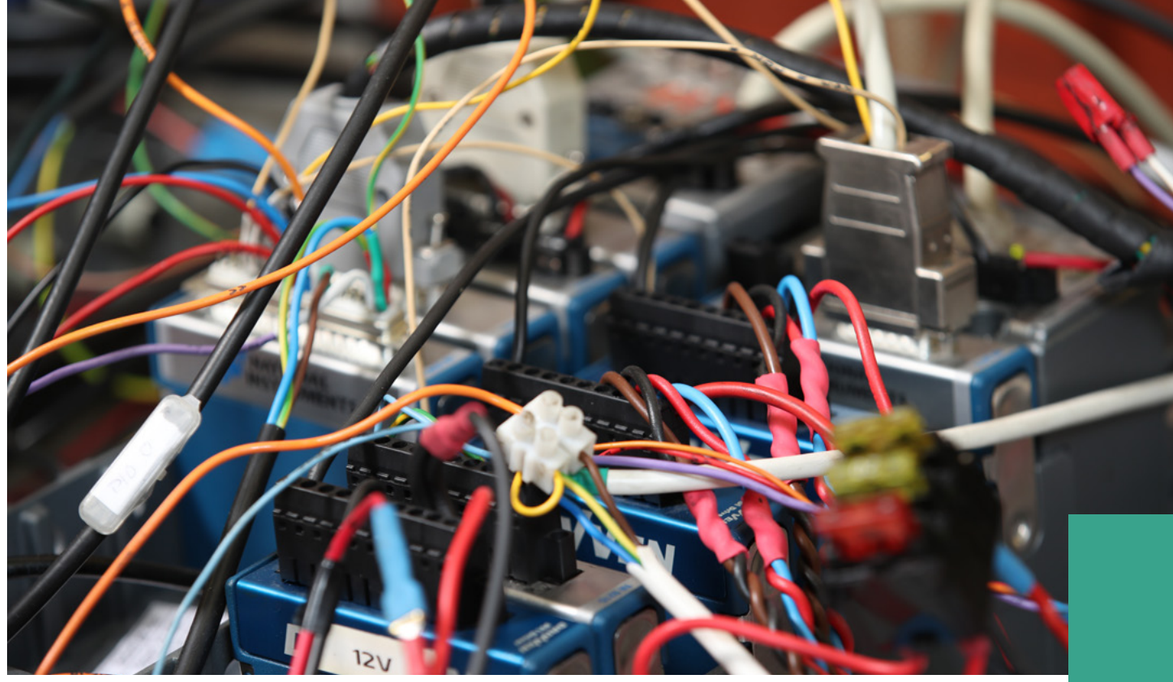
The Energy Engineering research programme is engaged in a wide range of activities:

In the field of internal combustion engines we research advanced designs of engine control and scavenging optimisation. We take part in designing future hybrid, electric and conventional powertrain systems.

In the field of fuel cells and batteries we have been developing next-generation electrochemical models containing nanomaterials.

To achieve high efficiency, durability, economic and environmental sustainability of the use of alternative fuels for, among other things, the research into stationary energy systems, we optimise the performance of systems for cogeneration of heat and electricity.

The research work in the field of turbine machines is concerned with the development of high efficiency and low noise systems. We develop cavitation erosion models. We also study the biological effects of cavitation for medical use and for wastewater treatment.



Laboratory for Internal Combustion Engines and Electromobility LICeM

RESEARCH AREAS

- Internal combustion engines • Alternative fuels • Exhaust emission
- Hybrid powertrain systems • Electric vehicles • Fuel cells • Batteries
- Numerical modelling of systems and components

DEPARTMENT HEAD Prof. Tomaž Katrašnik, PhD

DEPARTMENT MEMBERS Assist. Prof. Tine Seljak, PhD, Assist. Ambrož Kregar, PhD, Assist. Samuel Rodman Oprešnik, PhD, Assist. Gregor Tavčar, PhD, Assist. Rok Vihar, PhD, Assist. Anton Žnidarčič, PhD, Chowdhury Haque Amer Amor, PhD, Assist. Klemen Zelič, PhD, Assist. Urban Žvar Baškovič, PhD, Dev. Igor Mele, Assist. Andraž Kravos, Ivo Pačnik, Dev. Davor Rašić, Assist. Žiga Rosec, Tilen Tibaut, Tit Voglar, Assist. Mitja Drab, PhD, Assist. Matej Prijatelj, PhD, Assist. Jan Šuntajs, PhD, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

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CHOWDHURY, Amor, KLAMPFER, Saša, SREDENŠEK, Klemen, SEME, Sebastijan, HADŽISELIMOVIĆ, Miralem, ŠTUMBERGER, Bojan. Method for planning, optimizing, and regulating EV charging Infrastructure. Energies, ISSN 1996-1073, 2022, vol. 15.

RAŠIĆ, Davor, KATRAŠNIK, Tomaž. Multi-domain and multi-scale model of a fuel cell electric vehicle to predict the effect of the operating conditions and component sizing on fuel cell degradation. Energy conversion and management, ISSN 0196-8904. [Print ed.], Sep. 2022, vol. 268, str. 1-27.

ŽNIDARČIČ, Anton, KATRAŠNIK, Tomaž. A 3D CFD-based workflow for analyses of a wide range of flow and heat transfer conditions in air gaps of electric machines. Fluids, ISSN 2311-5521, 2022, vol. 7, iss. 8, str. 1-28.

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ZELIČ, Klemen, KATRAŠNIK, Tomaž. Computationally efficient quasi-3D model of a secondary electrode particle for enhanced prediction capability of the porous electrode model. Journal of the Electrochemical Society, ISSN 1945-7111. [Online ed.], Apr. 2022, vol. 169, no. 4, str. 1-14.

PROJECTS

Slovenian Research Agency. Advanced multi-scale modelling of NMC cathode materials for enhanced next-generation energy storage systems. Tomaž Katrašnik. 1.9.2020 - 31.8.2023

Horizon 2020 – MORELife. Material, Operating strategy and REliability optimisation for LIFEtime improvements in heavy duty trucks. Tomaž Katrašnik. 01.09.2021 - 31.08.2024

Slovenian Research Agency. Preparation of expert documents, design of a database and development of a vehicle simulation model for calculation of the energy and environmental footprint with an aim to optimize implementation of the public transport service. Tomaž Katrašnik. 01.09.2021 - 31.8.2024

Slovenian Research Agency. Multiscale modelling of degradation phenomena in membrane electrode assemblies of proton exchange membrane fuel cells produced of advanced materials. Tomaž Katrašnik. 01.02.2022 - 31.01.2024

Horizon Europa – INDY. Energy Independent and Efficient Deployable Military Camps. Tomaž Katrašnik. 01.12.2022 – 31.01.2025

Horizon Europa – PULSELION Pulsed Laser igitaliza tEchnology for soLid State battery igitalizatio supported by igitalization. Tomaž Katrašnik. 01.09.2022 - 31.08.2026

Horizon Europa – ADVAGEN Development of ADVAnced next GENeration Solid-State batteries for Electromobility Applications. Tomaž Katrašnik. 01.08.2022 - 31.07.2026

Austrian Research Promotion Agency (FFG) - MoSiLiB Modeling and development of silicon-tin sulfide composite anodes for generation 3b lithium-ion batteries. Tomaž Katrašnik. 01.06.2022 - 31.05.2025

European Defence Agency EDA – ELUVAT I. Innovative electric light utility all-terrain vehicle for defence purposes based on in-wheel electro motors. Tomaž Katrašnik. 3.2.2022 - 2.2.2023

AVL. Liion Battery. Development of modelling libraries for Li-ion batteries and fuel cells. Tomaž Katrašnik. 1.1.2022 - 31.12.2022

Petrol d.d. Razvoj in preverba metodologije in algoritmov za vrednotenje prihrankov energije med vožnjo vozila. Tomaž Katrašnik. 12.10.2022 - 30.6.2023

Towards the next generation of high performance li-ion battery cells - NEXTCELL (Obzorje Evropa). Tomaž Katrašnik. 1.1.2023 – 31.12.2026

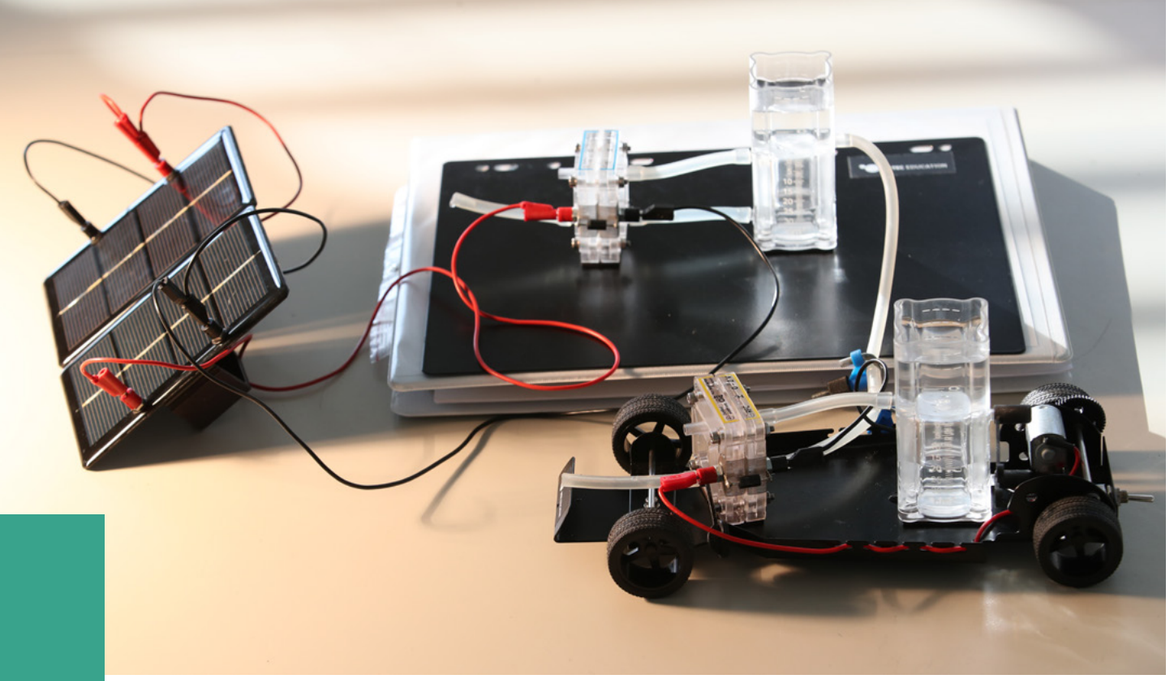
KPMG Support for Sustainable Energy and Mobiliy in the Slovenian Defence Sector. Tomaž Katrašnik. 15.12.2021 - 30.9.2022

PATENTS

KATRAŠNIK, Tomaž, ZELIČ, Klemen, CHOWDHURY, Amor, PAČNIK, Ivo, MELE, Igor, KRAVOS, Andraž. Computer-implemented method and data processing system for modelling and/or simulating and/or emulating a battery : Unated States Patent US 11,480,616%B2, 2022-10-25. Alexandria: United States Patent and Trademark Office, 2022.

AWARDS AND ACHIEVEMENTS

Davor Rašić, assist. Andraž Kravos and assist. Urban Žvar Baškovič, PhD received an award of the Faculty of Mechanical Engineering for high quality publications.



Laboratory for Heat and Power LTE

RESEARCH AREAS

• Energy systems • Heat generators • Combustion • Hydrogen technologies • Smart Grids • Life Cycle Assessment • Environmental impacts of energy conversion

DEPARTMENT HEAD Prof. Mihael Sekavčnik, PhD

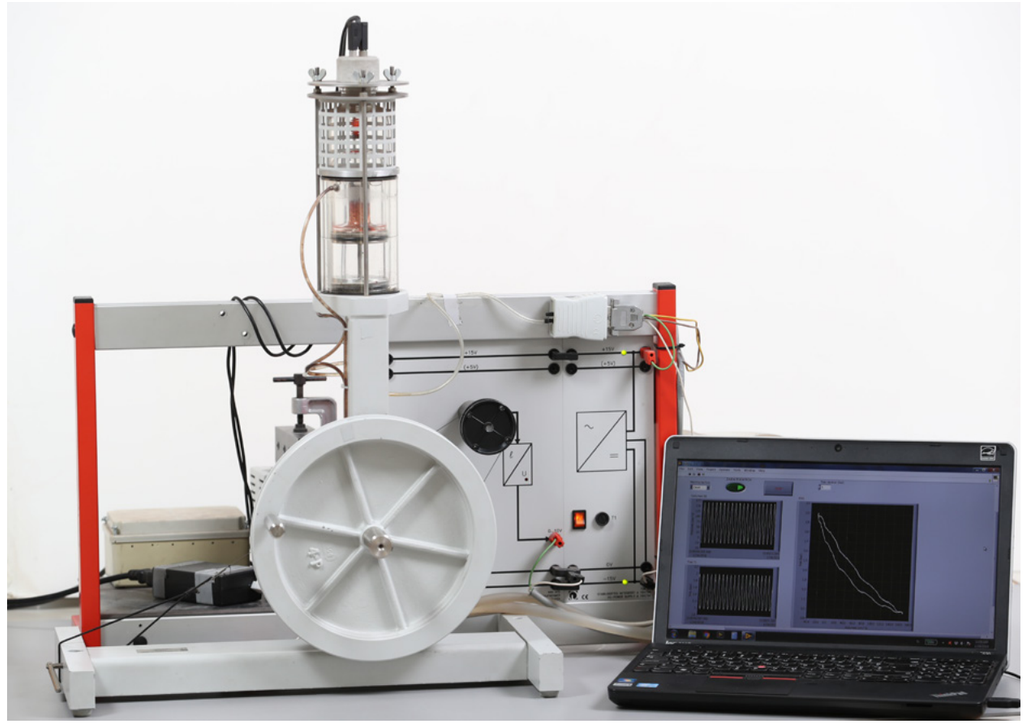
DEPARTMENT MEMBERS Assoc. Prof. Andrej Senegačnik, PhD, Assist. Prof. Boštjan Drobnič, PhD, Assist. Prof. Mitja Mori, PhD, Res. Assoc. Igor Kuštrin, PhD, Assist. Andrej Lotrič, PhD, Assist. Nejc Mlakar, Assist. Rok Stropnik, PhD, Assist. Jure Gramc, Assist. Emilija Dejanoska, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

MORI, Mitja, GUTIÉRREZ, Manuel, SEKAVČNIK, Mihael, DROBNIČ, Boštjan. Modelling and environmental assessment of a stand-alone micro-grid system in a mountain hut using renewables. Energies, ISSN 1996-1073, 2022, vol. 15, iss. 1, str. 1-21.

STROPNIK, Rok, MLAKAR, Nejc, LOTRIČ, Andrej, SEKAVČNIK, Mihael, MORI, Mitja. The influence of degradation effects in proton exchange membrane fuel cells on life cycle assessment modelling and environmental impact indicators. International journal of hydrogen energy, ISSN 0360-3199. [Print ed.], 2022, vol. 47, iss. 57, str. 24223-24241.

GRAMC, Jure, STROPNIK, Rok, MORI, Mitja. A company%s carbon footprint and sustainable development = Ogljični odtis podjetja in trajnostni razvoj. Journal of energy technology, ISSN 1855-5748. [Tiskana izd.], nov. 2022, vol. 15, iss. 3, str. 25-36.



STRUŠNIK, Dušan, KUŠTRIN, Igor, AVSEC, Jurij. Off-design flow analysis of cogeneration steam turbine with real process data. Thermal science, ISSN 0354-9836, 2022, issue 5, vol. 26, str. 4107-4117.

PROJECTS

Horizon 2020. eGhost. Establishing Eco-design Guidelines for Hydrogen Systems and Technologies. Mitja Mori. 01.01.2021-31.12.2023

Šoštanj Thermal Power Plant d. o. o. Izvedba strokovne podpore za preverjanje učinkov dolgoročne vzdrževalne pogodbe LTSA za blok 6. Igor Kuštrin. 1.3.2021 - 28.2.2022

Slovenian Research Agency. PROMETHEIA - Processes for metal-to-char encapsulation. Mihael Sekavčnik. 01.12.2021 - 30.11.2025

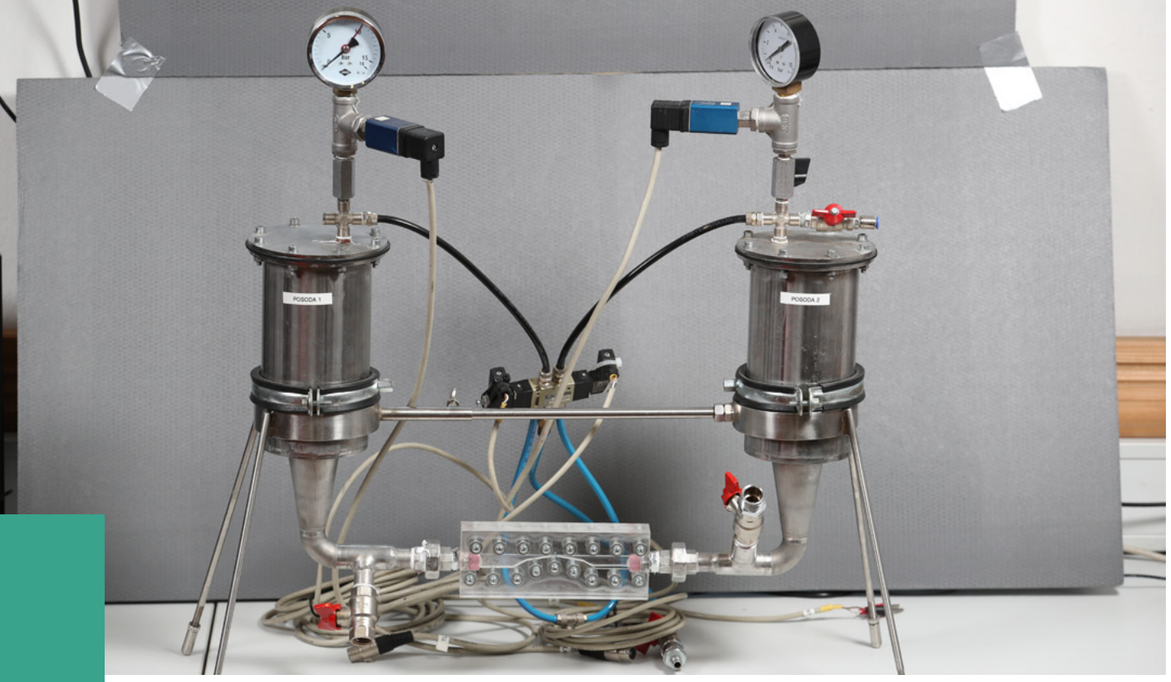
Horizon 2020. BEST4Hy. SustainaBlE SoluTions FOR recycling of end of life Hydrogen technologies. Mitja Mori. 01.01.2021 - 31.12.2023

Horizon Europe – SENERGY NETS. Increase the Synergy among different ENERGY NETworkS. Mitja Mori. 01.09.2022 - 30.08.2026

KPMG Support for Sustainable Energy and Mobiliy in the Slovenian Defence Sector. Mitja Mori. 15.12.2021 - 30.9.2022

Termoelektrarna Šoštanj, Strokovna podpora za preverjanje učinkov dolgoročne vzdrževalne pogodbe za blok 6, Mihael Sekavčnik. 1.4.2022 - 31.3.2025

Slovenian Research Agency, Ministry of Defence. Carbon footprint of Ministry of Defence. Mitja Mori. 01.10.2022 - 30.09.2023



Laboratory for Hydraulic Machines LVTS

RESEARCH AREAS

Fluid mechanics • Turbine machines • Computer aided visualisation

DEPARTMENT HEAD Prof. Marko Hočevar, PhD

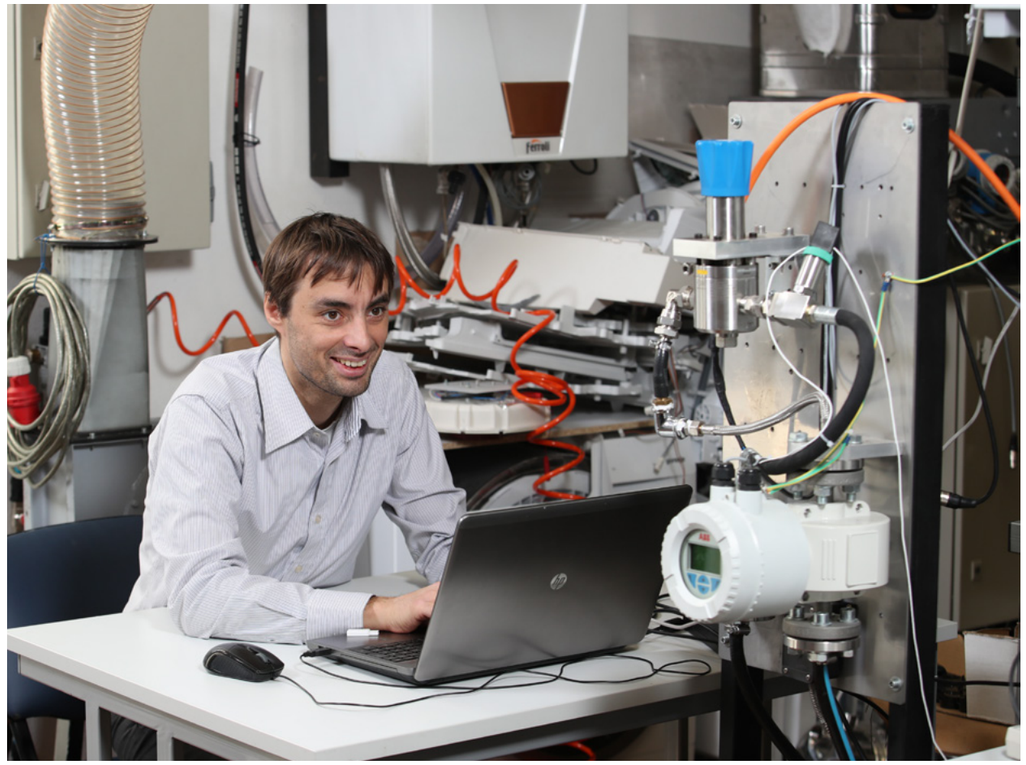
DEPARTMENT MEMBERS Prof. Matevž Dular, PhD, Assist. Prof. Benjamin Bizjan, PhD, Assist. Prof. Martin Petkovšek, PhD, Assist. Prof. Lovrenc Novak, PhD, Res. Assoc. Mojca Zupanc, PhD, Assist. Jurij Gostiša, Assist. Jure Zevnik, Ind. Dev. MSc Tone Godeša, Assist. Gregor Kozmus, Sr. Dev. Aleš Malneršič, Dev. Matej Sečnik, Assist. Žiga Pandur, Assist. Primož Drešar, PhD, Asist. Jernej Ortar, Biljana Stojković, Jr. Res. Žan Boček, Žiga Gruden, Rossello Juan Manuel, Žak Sovec, Jr. Res. Zupanc Andraž, Assist. Parham Kabirifar, PhD, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

REDLINGER-POHN, Jakob D., PETKOVŠEK, Martin, GORDEYEVA, Korneliya, ZUPANC, Mojca, GORDEEVA, Alisa, ZHANG, Qilun, DULAR, Matevž, SÖDERBERG, L. Daniel. Cavitation fibrillation of cellulose fiber. Biomacromolecules, ISSN 1525-7797, 2022, vol. 23, str. 847-862.

GOSTIŠA, Jurij, DREŠAR, Primož, HOČEVAR, Marko, DULAR, Matevž. Computational analysis of flow conditions in hydrodynamic cavitation generator for water treatment processes. The Canadian journal of chemical engineering, ISSN 1939-019X, Dec. 2022, vol. 100, iss. 12, str. 3502-3516.

GATARIĆ, Pero, ŠIROK, Brane, HOČEVAR, Marko, NOVAK, Lovrenc. Influence of load mass, drum speed and load composition on evenness of drying in a heat pump tumble dryer. Drying technology, ISSN 0737-3937. [Print ed.], 2022, vol. 40, iss. 10, str. 2175-2187.



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KOLBL REPINC, Sabina, BIZJAN, Benjamin, BUDHIRAJA, Vaibhav, DULAR, Matevž, GOSTIŠA, Jurij, BRAJER HUMAR, Barbara, KAURIN, Anela, KRŽAN, Andrej, LEVSTEK, Meta, MORALES ARTEAGA, Juan Francisco, PETKOVŠEK, Martin, RAK, Gašper, STRES, Blaž, ŠIROK, Brane, ŽAGAR, Ema, ZUPANC, Mojca. Integral analysis of hydrodynamic cavitation effects on waste activated sludge characteristics, potentially toxic metals, microorganisms and identification of microplastics. Science of the total environment, ISSN 0048-9697, Feb. 2022, vol. 806, pt. 4, str. 1-14.

FILIPIĆ, Arijana, LUKEŽIČ, Tadeja, BAČNIK, Katarina, RAVNIKAR, Maja, JEŠELNIK, Meta, KOŠIR, Tamara, PETKOVŠEK, Martin, ZUPANC, Mojca, DULAR, Matevž, GUTIÉRREZ-AGUIRRE, Ion. Hydrodynamic cavitation efficiently inactivates potato virus Y in water. Ultrasonics Sonochemistry, ISSN 1350-4177, January 2022, vol. 82, str. [1-19].

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ZEVNIK, Jure, DULAR, Matevž. Cavitation bubble interaction with compliant structures on a microscale : a contribution to the understanding of bacterial cell lysis by cavitation treatment. Ultrasonics Sonochemistry, ISSN 1350-4177, Jun. 2022, vol. 87, str. 1-20.

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PROJECTS

Horizon 2020 - ERC- CABUM - An investigation of the mechanisms at the interaction between cavitation bubbles and contaminants. Matevž Dular. 01.07.2018 – 31.3.2024

Slovenian Research Agency. Cavitation - a solution for microplastics degradation? Martin Petkovšek. 1.7.2019 – 30.6.2022

Slovenian Research Agency. Method for decontamination of sewage sludge and sludge products for their sustainable use as phosphorous fertilizers. Matevž Dular. 1.9.2020 - 31.8.2023

Slovenian Research Agency. Controlling extreme cavitation conditions by laser tailoring of surface functionalities (eCATS). Martin Petkovšek. 01.10.2021 - 30.09.2024

Slovenian Research Agency. Controlled generation of microbubbles and exploration of their physics for exploitation in chemistry, biology and medicine. Matevž Dular. 01.10.2021 - 30.09.2024

Slovenian Research Agency. Low emission household tumble drying with evaluation of damage to textile materials. Marko Hočevar- 01.10.2021 - 30.09.2024

Horizon Europe – H-HOPE. Hidden Hydro Oscillating Power for Europe. Marko Hočevar. 01.11.2022 - 31.10.2026

Horizon Europe – CAVIPHY. Exploitation of extreme cavitation conditions for wastewater treatment. Matevž Dular. 01.08.2022 - 31.01.2024

Horizon Europe – NASCAP. Nanobubbles Stabilization for Cleaning Applications. Matevž Dular. 20.06.2022 - 19.06.2024

ERDF - Uvedba novih mehanskih in avtonomnih avtomatiziranih tehnologij za trajnostno pridelavo grozdja. Marko Hočevar.

Ministry of Agriculture, Forestry and Fodd. EIP Pospešeno okopavanje zelenjave. Marko Hočevar. 19.05.2022 - 18.05.2025

Slovenian Research Agency. Removal of selected antimicrobials by plasma-cavitation hybrid technology from water matrices of varying complexity (Causma). Martin Petkovšek. 01.10.2022 - 30.09.2025

DOCTORAL DISSERTATION

ZEVNIK, Jure. Cavitation Bubble Interaction with Deformable Structures on a Micron Level : doctoral dissertation. Ljubljana: [J. Zevnik], 2022. Mentor: Matevž Dular

PANDUR, Žiga. Mehanizem delovanja kavitacijskih mehurčkov na bakterijsko celico : doktorska disertacija = Mechanism of action of the cavitation bubbles on bacterial cell : doctoral dissertation. Ljubljana: [Ž. Pandur], 2022. Mentor: David Stopar

PATENT

STOPAR, Matej, HOČEVAR, Marko. Method and system for selective, to flower set adapted, spraying of orchards = Verfahren und System zum selektiven, an den Blütenstand angepassten Spritzen von Obstgärten = Procédé et système de pulvérisation dans des vergers sélective et adaptée à des ensembles de fleurs : European patent specification EP 3 804 518 B1, 2022-07-27. München: European Patent Office, 2022.

AWARDS AND ACHIEVEMENTS

Assist. Jure Zevnik received an award of the Faculty of Mechanical Engineering for high quality publications.

ENERGY ENGINEERING

Laboratory for Pumps, Compressors and Technical Acoustics LEDSTA

RESEARCH AREAS

• Noise measurement and analysis • Environmental noise • Noise reduction • Identification and parametrisation of sound source • Prediction and modelling of noise propagation • Use of noise as a source of information • Psychoacoustics • Pumps • Ventilators • Compressors • Cavitation

DEPARTMENT HEAD Assoc. Prof. Jurij Prezelj, PhD

DEPARTMENT MEMBERS Assist. Luka Čurović, Assist. Jure Murovec, PhD, Tadej Novaković, Jr. Res. Železnik Anže, Nejc Cerkovnik, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

ČUROVIĆ, Luka, NOVAKOVIĆ, Tadej, GATARIĆ, Pero, MUROVEC, Jure, PREZELJ, Jurij. Experimental characterization of a household heat pump tumble dryer noise. Applied acoustics, ISSN 0003-682X. [Print ed.], Jan. 2022, vol. 188, str. 1-9.

PREZELJ, Jurij, ČUROVIĆ, Luka, NOVAKOVIĆ, Tadej, MUROVEC, Jure. A novel approach to localization of environmental noise sources : sub-windowing for time domain beamforming. Applied acoustics, ISSN 0003-682X. [Print ed.], Jun. 2022, vol. 195, str. 1-12.

PREZELJ, Jurij, EMRI, Igor, NIKONOV, Anatolij (umetnik). Evaluation of modulus of elasticity based on vibration modes identification using acoustic methods. Materials today : proceedings, ISSN 2214-7853, 2022.

ČUROVIĆ, Luka, MUROVEC, Jure, NOVAKOVIĆ, Tadej, PRISLAN, Rok, PREZELJ, Jurij. Time-frequency methods for characterization of room impulse responses and decay time measurement. Measurement : journal of the International Measurement Confederation, ISSN 0263-2241. [Print ed.], June 2022, vol. 196, str. 1-17.

PREZELJ, Jurij, MUROVEC, Jure, HUEMER-KALS, Severin, HÄSLER, Karl, FISCHER, Peter. Identification of different manifestations of nonlinear stick-slip phenomena during creep groan braking noise by using the unsupervised learning algorithms k-means and self-organizing map. Mechanical systems and signal processing, ISSN 0888-3270, Mar. 2022, vol. 166, str. 1-17.

POPIT, Andreja, ČUROVIĆ, Luka. Modeling underwater noise levels in the Slovenian Sea. Polish journal of environmental studies, ISSN 1230-1485, 2022.PREZELJ, Jurij, NIKONOV, Anatolij, EMRI, Igor. Using sound in the very near field of vibrating plates for determination of their mechanical properties. Applied Acoustics. [Online ed.], ilustr. ISSN 1872-910X Jan. 2022, vol. 186, 13 str.

PROJECTS

CORSAI (USA – California) - Noise control and Psychoacoustics of cooling fans. Jurij Prezelj. 2022-2023

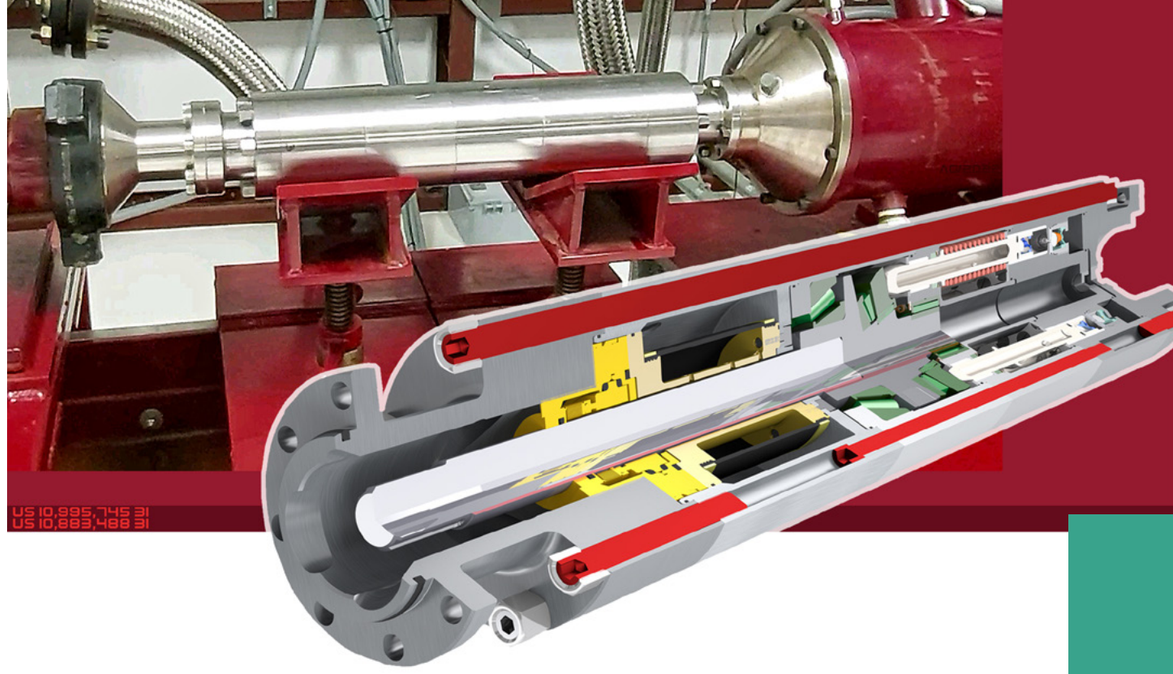
ENERGY ENGINEERING

04 DEVELOPMENT EVALUATION

In the Development evaluation programme group, we are improving upon the rebmix algorithm for finite mixture parameter estimation and the Dirlik method for fatigue life prediction in the frequency-domain.

We will model the stress-strain states of rubber and rubber composites and their fatigue life. We will improve the energy based method for the durability prediction of thermomechanically loaded components. We will research the lithium-ion batteries. We will improve the models of durability showing a significant break-point in the durability curve. We will research the modelling of the fatigue life of casted parts with inhomogeneities and of parts with a hybrid metal-nonmetal load-carrying structure.

Prediction of the behaviour of structures that are loaded with mechanical loads causing high strain rates in the material will be improved. For wood products, the influence of the probability distribution of occurrence and location of inhomogeneities on the material properties of wood will be determined. The damage initiation and damage propagation periods during fatigue of wood and wood-based composites and hybrids will be investigated.



Laboratory for Machine Elements LASEM

RESEARCH AREAS

Machine element • Operational strength • Development evaluations

DEPARTMENT HEAD Prof. Marko Nagode, PhD

DEPARTMENT MEMBERS Assist. Prof. Simon Oman, PhD, Assist. Ivan Okorn, PhD, Assist. Tadej Kocjan, Assist. Branislav Panić, PhD, Asisst. Andrej Škrlec, PhD, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

KOCJAN, Tadej, NAGODE, Marko, KLEMENC, Jernej, OMAN, Simon. Prediction of actual fatigue test temperature and isothermal fatigue life curves for non-crystallising rubber under fully relaxing uni-axial loading conditions. International journal of fatigue, ISSN 0142-1123, Apr. 2022, vol. 157, str. 1-13.

BARTOŠÁK, Michal, NAGODE, Marko, KLEMENC, Jernej, DOUBRAVA, Karel, ŠERUGA, Domen. Use of Prandtl operators in simulating the cyclic softening of Inconel 718 under isothermal low-cycle fatigue loading. International journal of mechanical sciences, ISSN 0020-7403, May 2022, vol. 222, str. 1-11.

PANIĆ, Branislav, NAGODE, Marko, KLEMENC, Jernej, OMAN, Simon. On methods for merging mixture model components suitable for unsupervised image segmentation tasks. Mathematics, ISSN 2227-7390, Nov. 2022, vol. 10, iss. 22, str. 1-22.

KATUNIN, Andrzej, NAGODE, Marko, OMAN, Simon, CHOLEWA, Adam, DRAGAN, Krzysztof. Monitoring of hidden corrosion growth in aircraft structures based on D-Sight inspections and image processing. Sensors, ISSN 1424-8220, Oct. 2022, vol. 22, iss. 19, str. 1-22.

MIKELJ, Martin, NAGODE, Marko, KLEMENC, Jernej, ŠERUGA, Domen. Influence of operating conditions on a cast-iron manhole cover. Technologies, ISSN 2227-7080, Dec. 2022, vol. 10, iss. 6, str. 1-10, ilustr.

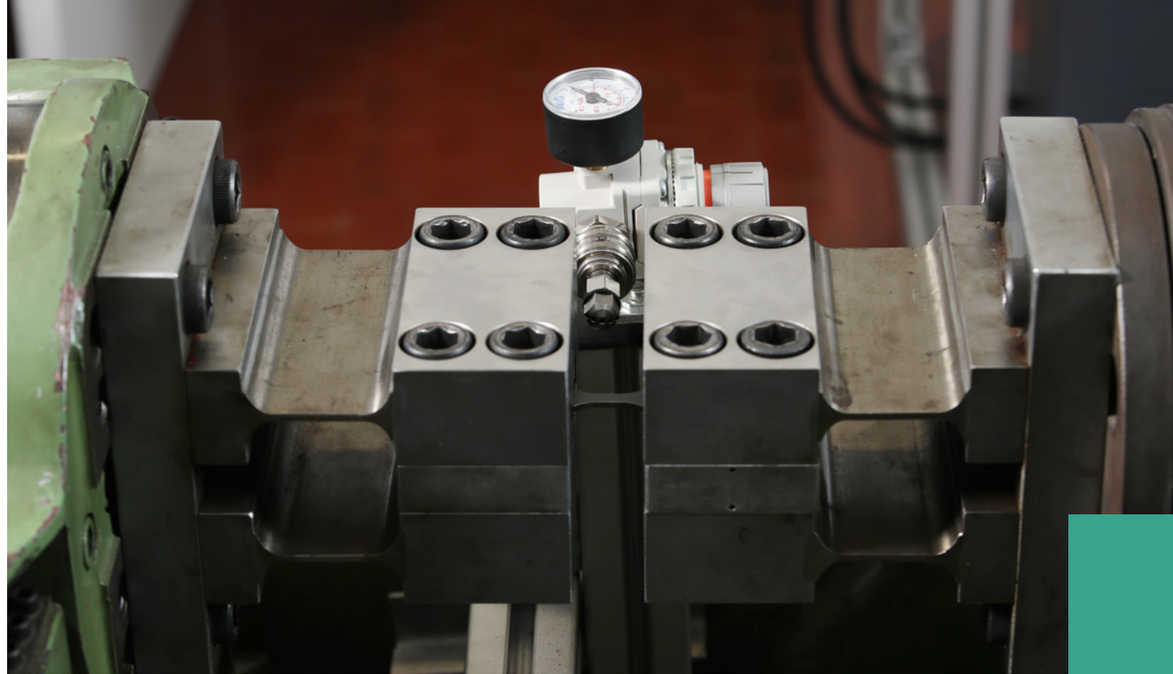
PROJECTS

Slovenian Research Agency - Analysis of failures that were detected at technical inspection procedures by using conventional statistical methods and data mining methods. Jernej Klemenc. 1.11.2019 – 31.10.2022

Horizon Europa. Erasmus +. Lightweight Design for Sustainable Mobility | LiDeSuM. Marko Nagode. 01.10.2022 - 31.12.2023

UNIVERSITY, HIGER EDUCATION OR SHORT-TERM HIGER EDUCATION TEXTBOOK WITH REVIEW

NAGODE, Marko, OMAN, Simon, ŠERUGA, Domen. Snovanje izdelkov z vidika zanesljivosti. 1. izd. Ljubljana: Fakulteta za strojništvo, 2022.



Laboratory for Structure Evaluation LAVEK

RESEARCH AREAS

• Development • Evaluation • Reliability • Maintainability • Supportability
• Availability • Dependability • Durability • Prediction

DEPARTMENT HEAD Prof. Jernej Klemenc, PhD

DEPARTMENT MEMBERS Assoc. Prof. Domen Šeruga, PhD, Assist. Dejan Tomažinčič, PhD, Assist. Peter Zobec, Tomaž Bešter, PhD, Assist. Aleš Gosar, PhD., Assist. Jure Kajbič, Assist. Aljaž Litrop, Nikonov Anatolij, Boris Šrklec, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

LITROP, Aljaž, ZOBEC, Peter, ŠERUGA, Domen, NAGODE, Marko, KLEMENC, Jernej. Experimental analysis of crack initiation and propagation in dynamically shear-loaded aluminium specimens using the digital image correlation method. Engineering failure analysis, ISSN 1350-6307, Sep. 2022, vol. 139, str. 1-11.

NEČEMER, Branko, KLEMENC, Jernej, ZUPANIČ, Franc, GLODEŽ, Srečko. Modelling and predicting of the LCF-behaviour of aluminium auxetic structures. International journal of fatigue, ISSN 0142-1123, Mar. 2022, vol. 156 (106673), str. 1-15.

LITROP, Aljaž, KLEMENC, Jernej, NAGODE, Marko, ŠERUGA, Domen. Design of a shear test fixture system and optimization of a metal shear specimen for cyclic loading. Journal of testing and evaluation, ISSN 0090-3973, 2022, vol. 50, iss. 5, str. 2345-2357.

KLEMENC, Jernej, FAJDIGA, Gorazd. Statistical modelling of the fatigue bending strength of Norway spruce wood. Materials, ISSN 1996-1944, 2022, vol. 15, iss. 2, str. 1-15.

TOMAŽINČIČ, Dejan, KLEMENC, Jernej. Estimate of Coffin%Manson curve shift for the porous alloy AlSi9Cu3 based on numerical simulations of a porous material carried out by using the Taguchi array. Materials, ISSN 1996-1944, Mar. 2022, vol. 15, iss. 6, str. 1-24.

ZOBEC, Peter, KLEMENC, Jernej. Yet another approach to fatigue crack growth simulation. Metals, ISSN 2075-4701, Mar. 2022, vol. 12, iss. 4, str. 1-17.

GLAVAN, Mitja, KLEMENC, Jernej, MALNARIČ, Vili, ŠERUGA, Domen. Incorporation of a simplified mechanical joint model into numerical analysis. Strojniški vestnik, ISSN 0039-2480, Jan. 2022, vol. 68, no. 1, str. 3-13.

PROJECTS

Slovenian Research Agency - Analysis of failures that were detected at technical inspection procedures by using conventional statistical methods and data mining methods. Jernej Klemenc. 1.11.2019 – 31.10.2022

AWARDS AND ACHIEVEMENTS

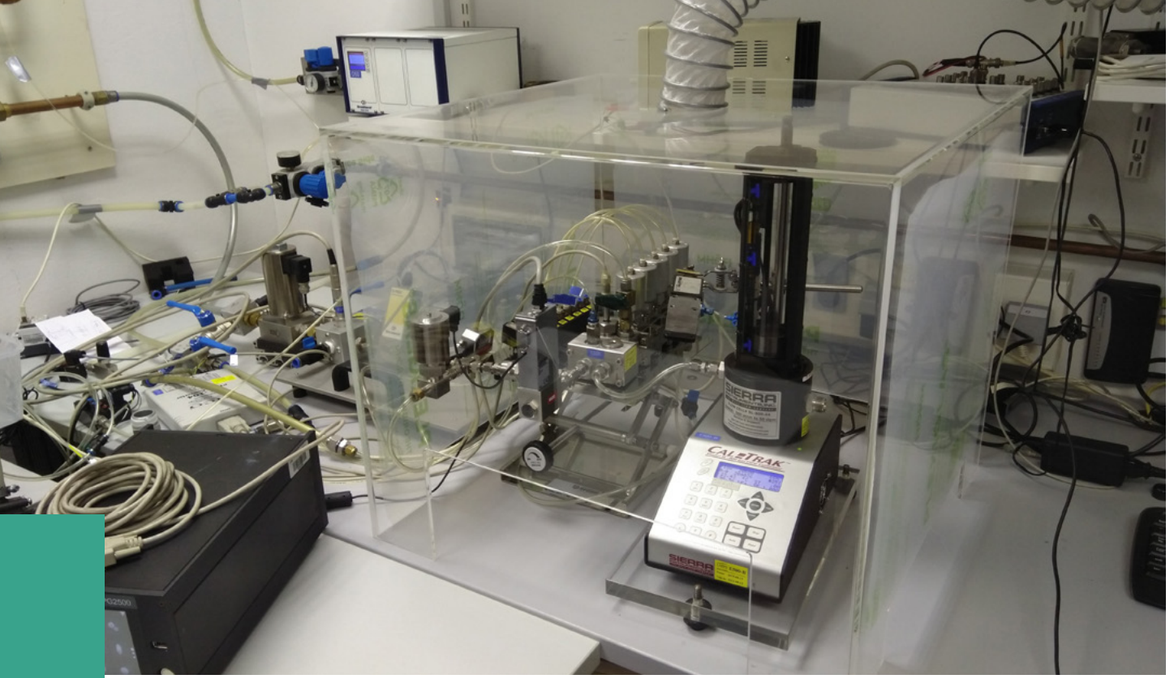
Assist. Dejan Tomažinčič, PhD received an award of the Faculty of Mechanical Engineering for excellence in teaching.

05 HEAT AND MASS TRANSFER

We conduct research and development of systems for the supply and use of energy for heating, cooling, air-conditioning and process engineering with emphasis on renewable energy sources and efficient use of energy.

We are engaged in advanced mechanisms of heat transfer and heat transport, a part of which includes boiling research in microstructures. We are involved in exergoeconomic optimisation of the entire energy supply chain. We research and develop alternative magnetocaloric and electrocaloric cooling technologies for real applications in the domain of conventional refrigerators with inclusion of thermal diodes and switches.

We conduct research of thermal response of cities with natural building elements and integration into buildings' envelope. We study the impact of cooling loads of buildings on electricity consumption and thermal comfort in buildings with inclusion of thermal storage. Research results are verified with measurements conducted in laboratories and on real systems for which innovative measuring methods and meters are being developed.



Laboratory for Measurements in Process Engineering LMPS

RESEARCH AREAS

Metrology • Measurements of temperature, pressure and fluid flow rate
• Development of measuring equipment and measurement methods
• Calibration

DEPARTMENT HEAD Assoc. Prof. Jože Kutin, PhD

DEPARTMENT MEMBERS Assist. Prof. Gregor Bobovnik, PhD, Assist. Prof. Andrej Svete, PhD, Marjan Pohl, Peter Sambol, Dev. Francisco Javier Hernandez Castro, Assist. Primož Žibret, Zdenka Rupič, Katja Tajč

ORIGINAL SCIENTIFIC ARTICLES

SVETE, Andrej, KUTIN, Jože. Identifying the high-frequency response of a piezoelectric pressure measurement system using a shock tube primary method. Mechanical systems and signal processing, ISSN 0888-3270, 1. jan. 2022, vol. 162, str. 1-15.

SVETE, Andrej, HERNÁNDEZ CASTRO, Francisco Javier, KUTIN, Jože. Effect of the dynamic response of a side-wall pressure measurement system on determining the pressure step signal in a shock tube using a time-of-flight method. Sensors, ISSN 1424-8220, Mar. 2022, vol. 22, iss. 6, str. 1-15.

ŽIBRET, Primož, BOBOVNIK, Gregor, KUTIN, Jože. Time-correction model based on diverter speed for a pVTt gas flow primary standard. Sensors, ISSN 1424-8220, May 2022, vol. 22, iss. 11, str. 1-12.

PROJECTS

Slovenian Research Agency. Advanced shock tube system for high-frequency primary dynamic pressure calibration. J2-3054. Andrej Svete. 01.10.2021 - 30.09.2024

Metrology infrastructure for high-pressure gas and liquified hydrogen flows. 20IND11 MetHyInfra. Jože Kutin. 01.06.2021 - 31.5.2024

HEAT AND MASS TRANSFER

Laboratory for Heating Technology LTT

RESEARCH AREAS

Heat and mass transfer • Thermal engineering • Applied thermodynamics • Process engineering • Biotechnology • Environmental protection technologies

DEPARTMENT HEAD Prof. Iztok Golobič, PhD

DEPARTMENT MEMBERS Assist. Prof. Matevž Zupančič, PhD, Assist. Prof. Matic Može, PhD, Assist. Ivan Sedmak, PhD, Assist. Jure Berce, Assist. Mattia Bucci, Assist. Armin Hadžić, Assist. Samo Jereb, Assist. Klara Arhar, Zdenka Rupič

ORIGINAL SCIENTIFIC ARTICLES

ZUPANČIČ, Matevž, GREGORČIČ, Peter, BUCCI, Mattia, WANG, Chi, AGUIAR, Gustavo Matana, BUCCI, Matteo. The wall heat flux partitioning during the pool boiling of water on thin metallic foils. Applied thermal engineering, ISSN 1359-4311. [Print ed.], Jan. 2022, vol. 200, str. 1-16.

SIELAFF, Axel, MANGINI, D., KABOV, O., RAZA, Md. Qaisar, GARIVALIS, Alekos Ioannis, ZUPANČIČ, Matevž, GOLOBIČ, Iztok, et al. The multiscale boiling investigation on-board the International Space Station : an overview. Applied thermal engineering, ISSN 1359-4311. [Print ed.], Mar. 2022, vol. 205, str. 1-23.

VAJC, Viktor, MOŽE, Matic, ZUPANČIČ, Matevž, ŠULC, Radek, GOLOBIČ, Iztok. IR measurements of heat transfer coefficients and nucleation parameters during saturated nucleate boiling of water/glycerin mixtures. Case studies in thermal engineering, ISSN 2214-157X, Apr. 2022, vol. 32, str. 1-13.

MOŽE, Matic, ZUPANČIČ, Matevž, SEDMAK, Ivan, FERJANČIČ, Klemen, GJERKEŠ, Henrik, GOLOBIČ, Iztok. Revisiting the corresponding-states-based correlation for pool boiling critical heat flux. Energies, ISSN 1996-1073, May 2022, vol. 15, iss. 10, str. 1-19.

ŽALEC, Domen, HANAK, Dawid P., MOŽE, Matic, GOLOBIČ, Iztok. Process development and performance assessment of flexible calcium looping biomass gasification for production of renewable gas with adjustable composition. International journal of energy research, ISSN 0363-907X, Apr. 2022, vol. 46, iss. 5, str. 6197-6215.

MOŽE, Matic, HADŽIĆ, Armin, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Boiling heat transfer enhancement on titanium through nucleation-promoting morphology and tailored wettability. International journal of heat and mass transfer, ISSN 0017-9310. [Print ed.], Oct. 2022, vol. 195, str. 1-17.

KORAČIN, Nejc, ZUPANČIČ, Matevž, VREČER, Franc, HUDOVORNIK, Grega, GOLOBIČ, Iztok. Characterization of the spray droplets and spray pattern by means of innovative optical microscopy measurement method with the high-speed camera. International journal of pharmaceutics, ISSN 0378-5173. [Print ed.], Dec. 2022, vol. 629, str. 1-8.

HADŽIĆ, Armin, MOŽE, Matic, ARHAR, Klara, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Effect of nanoparticle size and concentration on pool boiling heat transfer with TiO[sub]2 nanofluids on laser-textured copper surfaces. Nanomaterials, ISSN 2079-4991. [Online ed.], 2022, vol. 12, iss. 15, str. 1-22.

BREGAR, Tadej, VODOPIVEC, Matevž, PEČNIK, Tim, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Pool-boiling performance on thin metal foils with graphene-oxide-nanoflake deposit. Nanomaterials, ISSN 2079-4991. [Online ed.], Aug. 2022, vol. 12, iss. 16, str. 1-17.

MOŽE, Matic, ZUPANČIČ, Matevž, STEINBÜCHER, Miha, GOLOBIČ, Iztok, GJERKEŠ, Henrik. Nanosecond laser-textured copper surfaces hydrophobized with self-assembled monolayers for enhanced pool boiling heat transfer. Nanomaterials, ISSN 2079-4991. [Online ed.], Oct. 2022, vol. 12, iss. 22, str. 1-20.

JEREB, Samo, ZUPANČIČ, Matevž, MOŽE, Matic, GOLOBIČ, Iztok. Predicting the drop size passing through a superhydrophobic orifice. Physics of fluids, ISSN 1089-7666. [Online ed.], Nov. 2022, vol. 34, iss. 11, str. 1-8.

VIDOVIČ, Sara, BIZJAK, Alan, SITAR, Anže, HORVAT, Matej, JANKOVIĆ, Biljana, GOLOBIČ, Iztok. Development of a semi-empirical model for droplet size determination of a three-channel spray nozzle for pellet coating based on the optical method concept. Processes, ISSN 2227-9717. [Online ed.], Jan. 2022, vol. 10, iss. 1, str. 1-19.

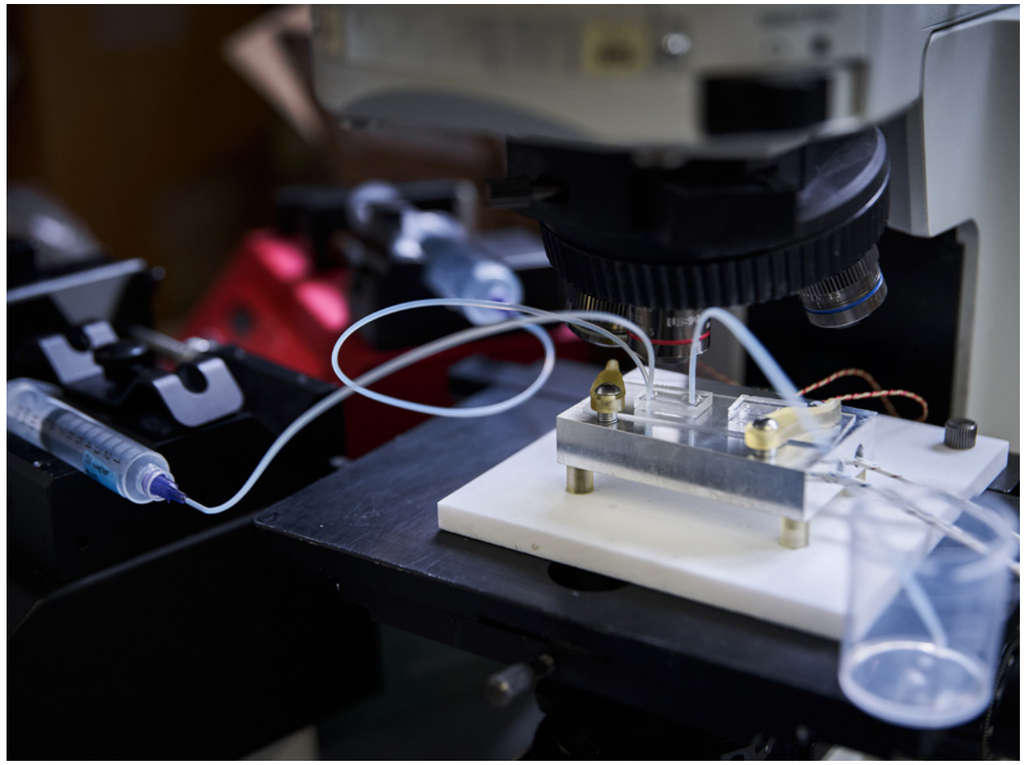
SERIANZ, Luka, RMAN, Nina, GOLOBIČ, Iztok, BRENČIČ, Mihael. Groundwater heat transfer and thermal outflow plume modelling in the Alps. Renewable energy, ISSN 0960-1481. [Print ed.], Jan. 2022, vol. 182, str. 751-763, ilustr.

SEDMAK, Ivan, PODLIPEC, Rok, URBANČIČ, Iztok, ŠTRANCAR, Janez, MORTIER, Michel, GOLOBIČ, Iztok. Spatially resolved temperature distribution in a rare-earth-doped transparent glass-ceramic. Sensors, ISSN 1424-8220, Mar. 2022, vol. 22, iss. 5, str. 1-11.

PROJECTS

Company Danfoss Trata. Development of smart heating station components for the DOM 24H project. Iztok Golobič. 4.12.2020-4.2.2022

Slovenian Research Agency. Enhanced boiling heat transfer utilising hierarchical functionalized surfaces (eHEATs). Matevž Zupančič. 1.9.2020 - 31.8.2023



Melamin d.d. Razvoj pilotnega reaktorja za temično razgradnjo težko razgradljivih organskih snovi v void. Iztok Golobič. 16.2.2021-14.9.2022

5Paskal. Optimisation of enhanced freeze drying process for R&D studies. Matevž Zupančič. 5.12.2022 - 14.12.2022

Slovenian Research Agency. Boiling Enhancement by Surface Texturing (BEST). Iztok Golobič. 01.01.2022 - 31.12.2025

DOCTORAL DISSERTATION

FERJANČIČ, Klemen. Vpliv strukture grelne površine na izboljšan prenos toplote in kritično gostoto toplotnega toka pri vrenju: doktorsko delo. Ljubljana: [K. Ferjančič], 2022. Mentor: Iztok Golobič

AWARDS AND ACHIEVEMENTS

Assist. Prof. Matevž Zupančič, PhD received an award of the Faculty of Mechanical Engineering for excellence in teaching.

Laboratory for Refrigeration and District Energy
LAHDE

RESEARCH AREAS

• Heat and Mass Transfer • Refrigeration • Caloric energy conversion
• Heat pumps • Thermal control devices • District energy

DEPARTMENT HEAD Prof. Andrej Kitanovski, PhD

DEPARTMENT MEMBERS Assist. Prof. Jaka Tušek, PhD, Assist. Dall`Olio Stefano, PhD, Assist. Urban Tomc, PhD, Assist. Boris Vidrih, PhD, Assist. Žiga Ahčin, Assist. Katja Klinar, PhD, Assist. Luka Lorbek, PhD, Sr. Dev. Nada Petelin, Assist. Luka Porenta, Assist. Miha Bobič, PhD, Simon Bogić, Assist. Jan Cerar, Simon Nosan, Assist. Katja Vozel, Anja Kuhelj, Assist. Pero Gatarić, Perne Jakob, Jr. Res. Tomaž Pšeničnik, PhD, Blaž Velkavrh, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

AHČIN, Žiga, KABIRIFAR, Parham, PORENTA, Luka, BROJAN, Miha, TUŠEK, Jaka. Numerical modeling of shell-and-tube-like elastocaloric regenerator. Energies, ISSN 1996-1073, Dec. 2022, vol. 15, iss. 23, str. 1-28.

POREDOŠ, Primož, PETELIN, Nada, VIDRIH, Boris, ŽEL, Tilen, MA, Qiuming, WANG, Ruzhu, KITANOVSKI, Andrej. Condensation of water vapor from humid air inside vertical channels formed by flat plates. iScience, ISSN 2589-0042. [Online ed.], Jan. 2022, vol. 25, iss. 1, str. 1-26.

KLINAR, Katja, VOZEL, Katja, SWOBODA, Timm, SOJER, Tom, MUÑOZ ROJO, Miguel, KITANOVSKI, Andrej. Ferrofluidic thermal switch in a magnetocaloric device. iScience, ISSN 2589-0042. [Online ed.], Feb. 2022, vol. 25, iss. 2, str. 1-15.

PETELIN, Nada, VOZEL, Katja, KLINAR, Katja, KITANOVSKI, Andrej. The numerical study on performance evaluation of a thermal switch capacitor in a magnetocaloric cooling device. iScience, ISSN 2589-0042. [Online ed.], Dec. 2022, vol. 25, iss. 12, str. 1-20.

AHČIN, Žiga, DALL´OLIO, Stefano, ŽEROVNIK, Andrej, ŽVAR BAŠKOVIČ, Urban, PORENTA, Luka, KABIRIFAR, Parham, CERAR, Jan, ZUPAN, Samo, BROJAN, Miha, KLEMENC, Jernej, TUŠEK, Jaka. High-performance cooling and heat pumping based on fatigue-resistant elastocaloric effect in compression. Joule, ISSN 2542-4351, Oct. 2022, vol. 6, nr. 10, str. 2338-2357.

KABIRIFAR, Parham, TROJER, Jonas, BROJAN, Miha, TUŠEK, Jaka. From the elastocaloric effect towards an efficient thermodynamic cycle. JPhys energy, ISSN 2515-7655, 2022, vol. 4, nr. 4, str. 1-22.

VOZEL, Katja, KLINAR, Katja, KITANOVSKI, Andrej. Protocol to evaluate a (magneto)caloric device with static thermal switches using a 1D numerical model. STAR protocols, ISSN 2666-1667, Sep. 2022, vol. 3, iss. 3, str. 1-14.

PROJECTS

Gorenje d.d. - Development of thermal processes in household appliances. Andrej Kitanovski. 23.2.2020-21.2.2022

Slovenian Research Agency. MagBoost: Magnetocaloric booster micro-heat pump for district heating system. Andrej Kitanovski. 1.9.2020 - 31.8.2023

Slovenian Research Agency. TCCbuilder: An open-source simulation tool for thermal control circuits. Andrej Kitanovski. 1. 10. 2021 – 31. 8. 2023

Slovenian Research Agency. Solid-state cooling with pressure: Developement of barocaloric cooling device (COOL PRESS). Jaka Tušek. 01.10.2022 - 30.09.2025

Horizon Europe. Energy Independent and Efficient Deployable Military Camps | INDY. Andrej Kitanovski. 01.12.2022 - 31.01.2025

Horizon Europe. Increase the Synergy among different ENERGY NETworkS | SENERGY NETS. Andrej Kitanovski. 01.09.2022 - 31.08.2026

LIFE. 3DIVERSE. Decentralization, Diversity and Dynamic load regulation – novel approaches to tangible energy transition with diversification of production sources. Andrej Kitavnovski. 01.10.2022 - 30.09.2025

Infineon Technologies AG, Gorenje d.o.o. Joint Reverse Engineering Analysis. Andrej Kitavnovski. 28.10.2022 - 6.2.2023

Gorenje d.o.o. Raziskovalno razvojno sodelovanje na področju toplotno snovnih procesov v gospodinjskih aparatih (Aneks 2). Andrej Kitanovski. 23.2.2022 - 23.2.2024

MIZŠ - ERA-NET. Battery Thermal Managament System Based on High Power Density Digital Microfluidic Magnetocaloric Cooling | Cool BatMan. Urban Tomc. 01.11.2022 - 31.10.2025

DOCTORAL DISSERTATION

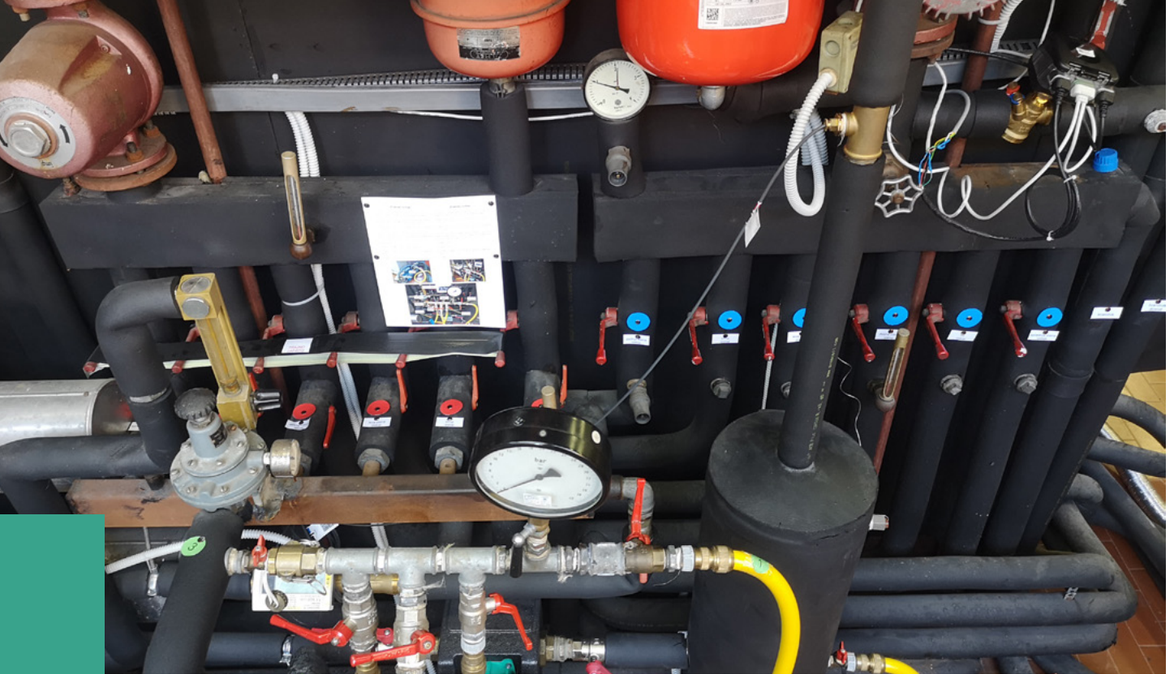
KLINAR, Katja. The application of thermal switches and thermal diodes in a system with cyclical temperature change : dissertation. Ljubljana: [K. Klinar], 2022. Mentor: Andrej Kitanovski

AWARDS AND ACHIEVEMENTS

Assist. Žiga Ahčin received an award of the Faculty of Mechanical Engineering for high quality publications.

Assist. Katja Klinar, PhD have won the national L'Oréal-UNESCO For Women in Science scholarships for 2022.

The 10 most outstanding research achievements of 2022 were announced as part of the University of Ljubljana Week. The award for the research entitled Development of an energy-efficient and fast-response electro-permanent magnet with magnetic energy regeneration was awarded to Urban Tomc, PhD Simon Nosan, Katja Klinar, PhD, Blaž Jelenc, PhD, Prof. Alojz Poredoš, PhD and Prof. Andrej Kitanovski, PhD.



Laboratory for Heating, Sanitary, Solar and Air Conditioning Engineering LOSK

RESEARCH AREAS

Heat and mass transfer in buildings and building installations • Indoor environment • Ventilation • Air conditioning • Efficient use of energy • Environment protection (air) • Sanitary engineering • Alternative systems • Modelling

DEPARTMENT HEAD Assoc. Prof. Uroš Stritih, PhD

DEPARTMENT MEMBERS Assoc. Prof. Matjaž Prek, PhD, Assist. Eneja Osterman, PhD, Assist. Eva Zavrl, Assist. Urška Mlakar, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

OSTERMAN, Eneja, STRITIH, Uroš, DOVJAK, Mateja, VAUPOTIČ, Janja, VERBAJS, Tomaž, MLAKAR, Urška, ZAVRL, Eva. Analysis of educational building%s ventilation suitability to prevent the spread of coronavirus (SARS-CoV-2). Strojniški vestnik, ISSN 0039-2480, Apr. 2022, vol. 68, no. 4, str. 233-239.

MARČENKO, Erik, LAMPRET, Žiga, PREK, Matjaž. Correlation between air pollution and the spread and development of COVID-19 related disease. Strojniški vestnik, ISSN 0039-2480, Apr. 2022, vol. 68, no. 4, spec. iss.: SARS-Cov-2, str. 272-280.

ZAVRL, Eva, EL MANKIBI, Mohamed, DOVJAK, Mateja, STRITIH, Uroš. Experimental investigation of air-based active-passive system for cooling application in buildings. Sustainable cities and society, ISSN 2210-6715. [Spletna izd.], Oct. 2022, vol. 85, str. 1-13.

PROJECTS

Horizon 2020. HEART. Holistic Energy and Architectural Retrofit Toolkit. Uroš Stritih. 1.10.2017 - 31.7.2022

AWARDS AND ACHIEVEMENTS

Assoc. Prof. Uroš Stritih, PhD became the honorary congress ambassador of Slovenia.

HEAT AND MASS TRANSFER

Laboratory for Sustainable Technologies in Buildings LOTZ

RESEARCH AREAS

Engineering sciences • Energy engineering • Renewable sources and technologies

DEPARTMENT HEAD Prof. Sašo Medved, PhD

DEPARTMENT MEMBERS Assoc. Prof. Ciril Arkar, PhD, Assist. MSc Suzana Domjan, Assist. Tej Žižak, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

ŽIŽAK, Tej, DOMJAN, Suzana, MEDVED, Sašo, ARKAR, Ciril. Efficiency and sustainability assessment of evaporative cooling of photovoltaics. Energy, ISSN 0360-5442, Sep. 2022, vol. 254, pt. A, str. 1-12.

ARKAR, Ciril, ŽIŽAK, Tej, DOMJAN, Suzana, MEDVED, Sašo. Comparative analysis of free cooling of photovoltaics % phase change versus evaporative cooling. Journal of energy storage, ISSN 2352-152X. [Print ed.], May 2022, vol. 49, str. 1-13.

PROJECTS

Slovenian Research Agency. Development of technical guidelines for quadruple glazing. Sašo Medved. 1.10.2021 - 30.9.2024

Eureka. SWDGR Storm-water detention green roofs with online modeling application. Ciril Arkar. 1.9.2020 - 31.8.2023

Ministry of the Environment and Spatial Planning. Draft rules on energy performance of buildings, TSG 004-1 and explanatory document. Sašo Medved. 9.7.2019 - 31.1.2022

Slovenian Research Agency. Living Walls for Future Sustainable Buildings and Cities. Ciril Arkar. 01.10.2022 - 30.09.2025

SCIETIFIC MONOGRAPH

MEDVED, Sašo. Building physics : heat, ventilation, moisture, light, sound, fire, and urban microclimate, (Springer tracts in civil engineering). Cham: Springer, cop. 2022.

AWARDS AND ACHIEVEMENTS

Assist. Tej Žižak received an award of the Faculty of Mechanical Engineering for high quality publications.

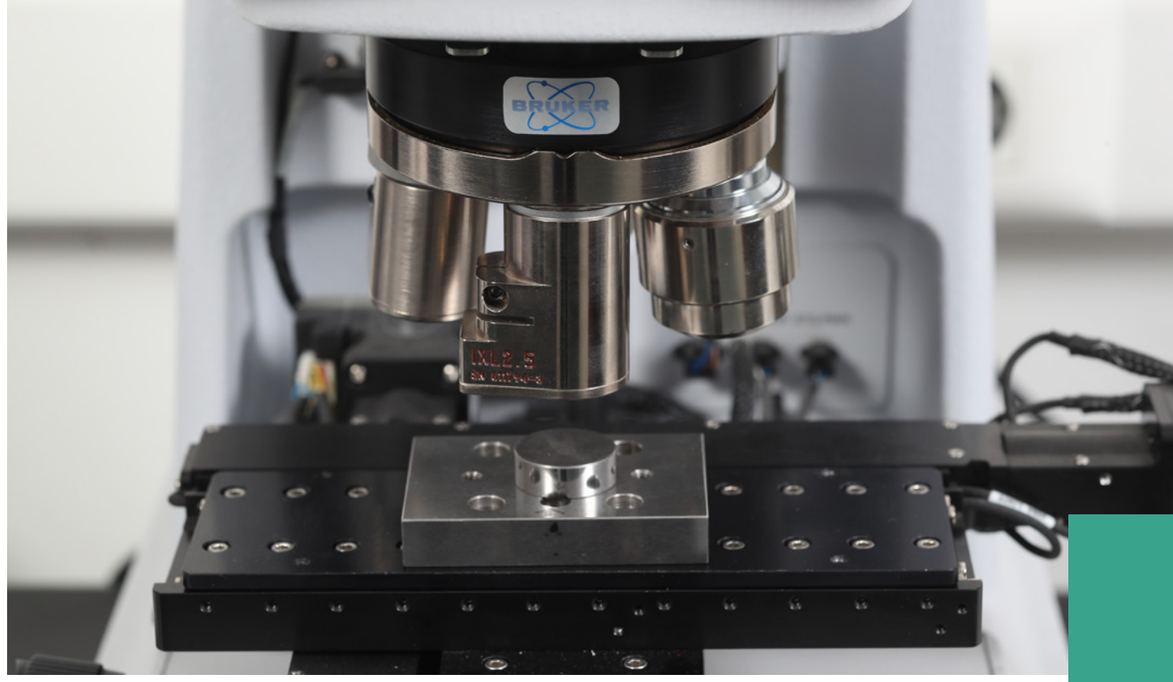
HEAT AND MASS TRANSFER

06 TRIBOLOGY

The Tribology programme group is interdisciplinary and includes 15-20 member from different disciplines: mechanical engineering, physics, chemistry, materials and nanotechnologies.

The group is developing an energy-efficient, sustainable and at the same time more environment-friendly “green” operation of mechanical systems. Linking understanding of tribological and surface processes from nano- to macroscale with the aim of solving industrial problems is the group’s basic goal. The central closely-related areas of work are: contact engineering and surface mechanics, wear-resistant mechanical systems, protective surface coatings, lubrication and surface films, nanotribology, wetting, tribochemestry and adhesion processes, and power-control hydraulic design.

The group is also actively engaged in topography and real contact area models, advanced polymer, electrical and mechatronic contacts tribology, tribology in production processes, polymer gears and automotive applications, and water hydraulics.



Laboratory for tribology and interface nanotechnology TINT

RESEARCH AREAS

Wear • Lubrication • Friction • Surface engineering • Nanotribology • Interface nanotechnology • Maintenance

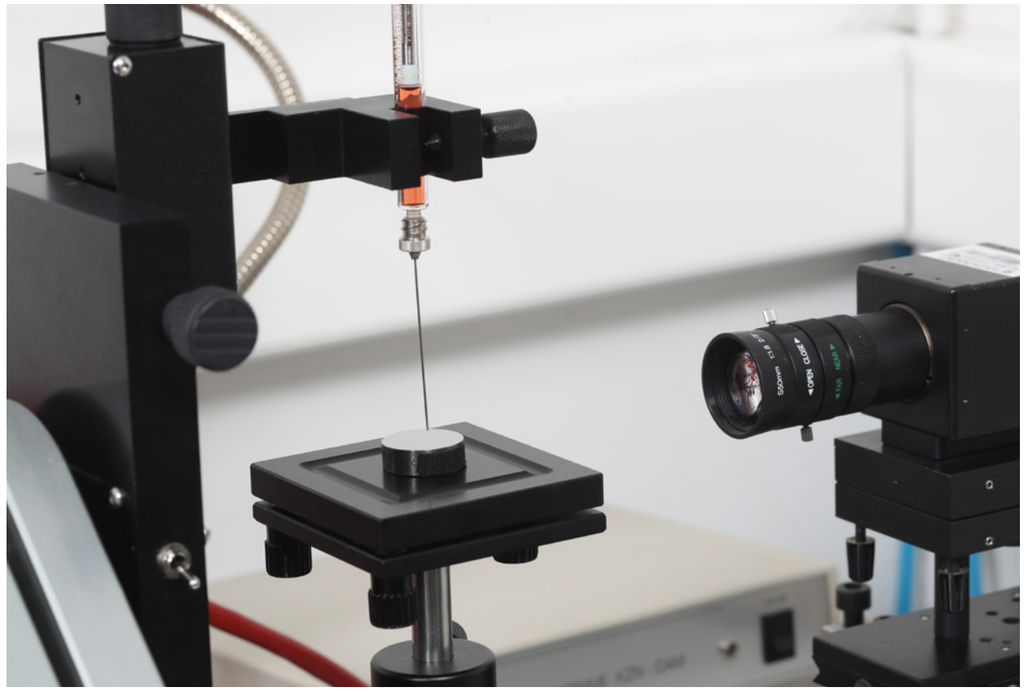
DEPARTMENT HEAD Prof. Mitjan Kalin, PhD

DEPARTMENT MEMBERS Assist. Prof. Marko Polajnar, PhD, Assist. Prof. Janez Kogovšek, PhD, Assist. Arshad Muhammad Shahid, PhD, Assist. Blaž Žugelj, PhD, Assist. Lucija Čoga, PhD, Assist. Jure Jerina, PhD, Assist. Urban Klanjšček, Assist. Sebastjan Matkovič, Assist. Hamouda Karim, Assist. Siddiqui Muhammad Shoaib Naseem, Franc Kopač, Assist. Petra Jan, Prashant Gangwani, Pedro Martins Ferreira, Irfan Nadeem, Sr. Res. Assoc. Tomaž Požar, Jr. Res. Osolnik Nejc, PhD, Assist. Anastasia Sampdurova, PhD, Jožica Sterle

ORIGINAL SCIENTIFIC ARTICLES

JAPIĆ, Dajana, KULOVEC, Simon, KALIN, Mitjan, SLAPNIK, Janez, NARDIN, Blaž, HUSKIĆ, Miroslav. Effect of expanded graphite on mechanical and tribological properties of polyamide 6/glass fibre composites. Advances in polymer technology, ISSN 0730-6679, 2022, vol. 2022, str. 1-8.

BASTAKYS, Lukas, MARCINAUSKAS, Liutauras, MILIEŠKA, Mindaugas, GRIGALIUNAS, Matas, MATKOVIČ, Sebastjan, AIKAS, Mindaugas. Tribological properties of chromia and chromia composite coatings deposited by plasma spraying. Coatings, ISSN 2079-6412, 2022, vol. 12, iss. 7, str. 1-9.



ČOGA, Lucija, AKBARI, Somayeh, KOVAČ, Janez, KALIN, Mitjan. Differences in nano-topography and tribochemistry of ZDDP tribofilms from variations in contact configuration with steel and DLC surfaces. Friction, ISSN 2223-7690, Feb. 2022, vol. 10, iss. 2, str. 296%315.

SHARMA, Sandan Kumar, CHAUDHARY, Kapil, GUPTA, Yashpal, KALIN, Mitjan, KUMAR, B. V. Manoj. Erosive wear behavior of spark plasma-sintered SiC%TaC composites. International journal of applied ceramic technology, ISSN 1546-542X, May/Jun. 2022, vol. 19, iss. 3, str. 1691-1701.

ASTRATH, Nelson Guilherme Castelli, FLIZIKOWSKI, Gabriel Antonio Siqueira, ANGHINONI, B., MALACARNE, Luis Carlos, BAESSO, Mauro L., POŽAR, Tomaž, PARTANEN, M., BREVIK, Iver Håkon, RAZANSKY, D., BIALKOWSKI, Stephen Edward. Unveiling bulk and surface radiation forces in a dielectric liquid. Light, science & applications, ISSN 2047-7538, Apr. 2022, vol. 11, str. 1-10.

SHANKAR VADIVEL, Hari, SOMBERG, Julian, KALIN, Mitjan, EMAMI, Nazanin. Tribological performance of a UHMWPE-based multiscale composite under different lubrication and loads. Lubrication science, ISSN 0954-0075, Nov. 2022, vol. 34, iss. 7, str. 480-492.

SHANKAR VADIVEL, Hari, AL-MAQDASI, Zainab, PUPURE, Liva, JOFFE, Roberts, KALIN, Mitjan, EMAMI, Nazanin. Time-dependent properties of newly developed multiscale UHMWPE composites. Polymer testing, ISSN 0142-9418. [Print ed.], Jan. 2022, vol. 105, str. 1-10.

JING, Zhaogang, GUO, Feng, JIN, Wei, KALIN, Mitjan, POLAJNAR, Marko. Study on the influence of interfacial slip on the lubrication performance of a step slider bearing. Tribology international, ISSN 0301-679X, Dec. 2022, vol. 176, str. 1-9.

PROJECTS

Erasmus + (Erasmus Mundus) - TRIBOS+ - Joint European Master on Tribology of Surfaces and Interfaces. Mitjan Kalin. 01.09.2018 – 31.08.2024

Horizon 2020 – GreenTRIBOS. Mitjan Kalin. 01.01.2020 - 31.12.2023

Slovenian Research Agency. Tribological surface design with advanced metal additive manufacturing – TriboADAM. Mitjan Kalin. 1.9.2020 - 31.8.2023

Slovenian Research Agency. Nanoscale contact design of high-performance, energy-efficient, lightweight components for green mobility (CODE-GM). Mitjan Kalin. 01.10.2022 - 30.09.2025

PATENTS

SUSIČ, Egon, SAVŠEK, Pavel, POŽAR, Tomaž, PETKOVŠEK, Rok. Cavitation sensing unit for providing a cavitation sensing signal and being adapted to be connected to a control valve of a hydrodynamic system : patentskrift DK 180883 B1, 2022-06-13. Taastrup: Danmark Patent-og Varemærkestyrelsen: = Danish Patent and Trademark Office, 2022.

KALIN, Mitjan. Postopek obdelave drsne površine kovinskega strojnega dela : patent SI 26180 A, 2022-10-28. Ljubljana: Urad Republike Slovenije za intelektualno lastnino, 2022.

DOCTORAL DISSERTATION

SHANKAR VADIVEL, Hari. Development of new multiscale polymer composites for water lubricated tribological contacts : dissertation. Ljubljana: [H. S. Vadivel], 2022. Mentor: Emami Nazanin; Mentor: Mitjan Kalin

Laboratory for Fluid Power and Controls LFT

RESEARCH AREAS

Fluid power • Oil and water hydraulics • Numerical simulations • Hydraulic components and systems • Control • Component and system development • Durability tests • Diagnostics in hydraulics

DEPARTMENT HEAD Assist. Prof. Franc Majdič, PhD

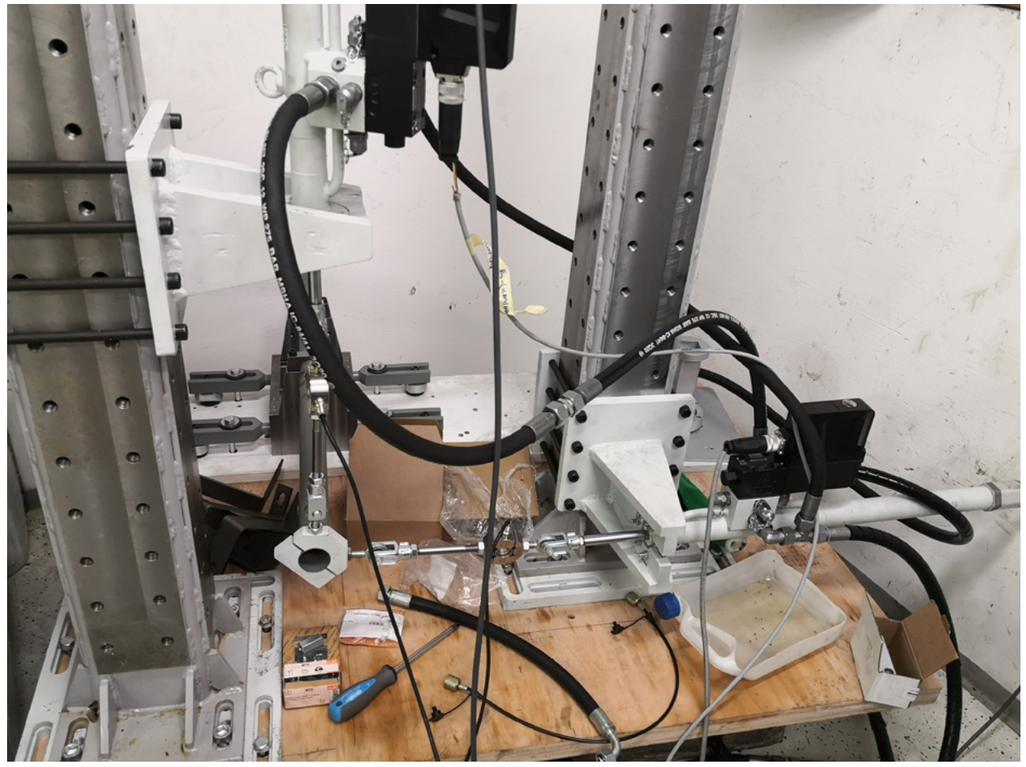
DEPARTMENT MEMBERS Rok Jelovčan, Dev. Nejc Novak, Assist. Ana Trajkovski, PhD, Assist. Jan Pustavrh, Jan Bartolj, Jožica Sterle

ORIGINAL SCIENTIFIC ARTICLES

BARTOLJ, Jan, TRAJKOVSKI, Ana, MAJDIČ, Franc, ČELIK, Anže. Razvoj, izdelava in testiranje proporcionalnega potnega ventila, izdelanega s 3D-tiskanjem kovin in z uporabo topološke optimizacije. Ventil : revija za fluidno tehniko in avtomatizacijo, ISSN 1318-7279. [Tiskana izd.], jun. 2022, letn. 28, št. 3, str. 190-196.

BOŽIČ, Dominik, MAJDIČ, Franc. Razvoj miniaturnega proporcionalnega hidravličnega ventila za krmiljenje gibov humanoidnega robota. Ventil : revija za fluidno tehniko in avtomatizacijo, ISSN 1318-7279. [Tiskana izd.], okt. 2022, letn. 28, št. 5, str. 330-336.

PUSTAVRH, Jan, PEPERKO, Aljoša, MAJDIČ, Franc. Razvoj hidravličnega sistema Stewartove ploščadi. Ventil : revija za fluidno tehniko in avtomatizacijo, ISSN 1318-7279. [Tiskana izd.], dec. 2022, letn. 28, št. 6, str. 396-403.



PROJECTS

Ministry of Agriculture, Forestry and Food. EIP. Pospešeno okopavanje zelenjave. Franc Majdič. 19.05.2022 - 18.05.2025

Slovenian National Building and Civil Engineering Institute. Dobava in montaža hidravličnega cevnega razvoda. Franc Majdič. 31.1.2022 - 31.10.2022

Akrapovič d.o.o. BWT na hidravliko. Franc Majdič. 28.7.2021 - 27.12.2022

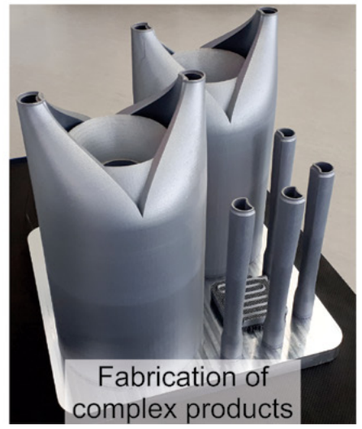
07 SYNERGETICS OF COMPLEX SYSTEMS AND PROCESSES

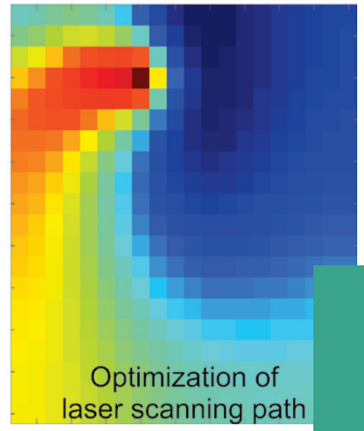
Development of new as well as optimisation of existing technologies, systems and processes with complex and time-varying properties requires an understanding of the mutual nonlinear interactions which can often lead to instabilities and even chaos, and are reflected in the corresponding temporal spatial structures.

The main aim of the research programme is to contribute to world science with regards to description and understanding of complex technological systems and processes. Methods of research are based on synergetic approach to complex systems which includes use of advanced methods of probability and statistics, information theory, chaotic dynamics, soft computing, data mining, adaptive empirical modelling, machine learning, methods of optimisation and predictive control. Within the context of the programme, research is conducted in the field of additive technologies using direct laser deposition of materials, in the field of adaptive information systems for automated monitoring, optimisation and control of complex technological systems and processes, and in the field of non-destructive diagnostics of loaded materials and products.

3D printing with selective laser melting (SLM)


SLM process


Fabrication of complex products


Optimization of laser scanning path

Laboratory for Synergetics LASIN

RESEARCH AREAS

Synergetics • Technology driven physics • Additive manufacturing • Direct laser deposition • Empirical modelling and industrial diagnostics • Optimisation and predictive control

DEPARTMENT HEAD Prof. Edvard Govekar, PhD

DEPARTMENT MEMBERS Assist. Prof. Primož Potočnik, PhD, Assist. Andrej Jeromen, PhD, Assist. Jaka Peternel, Assist. Jaka Simončič, Teja Pirnat

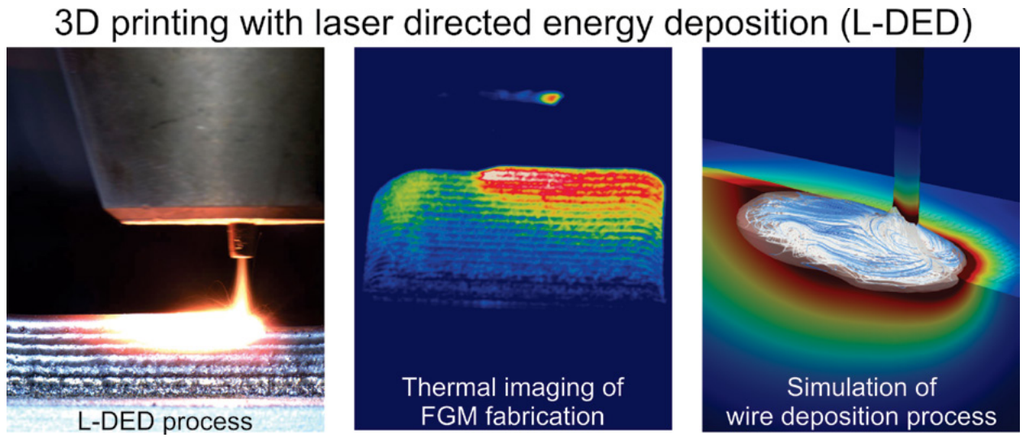
ORIGINAL SCIENTIFIC ARTICLES

POTOČNIK, Primož, MISSON, Martin, ŠTURM, Roman, GOVEKAR, Edvard, KEK, Tomaž. Deep feature extraction based on ae signals for the characterization of loaded carbon fiber epoxy and glass fiber epoxy composites. Applied sciences, ISSN 2076-3417, Feb. 2022, vol. 12, iss. 4, str. 1-13.

JEROMEN, Andrej, VIDERGAR, Ana, FUJISHIMA, Makoto, LEVY, Gideon N., GOVEKAR, Edvard. Powder particle%wall collision-based design of the discrete axial nozzle-exit shape in direct laser deposition. Journal of materials processing technology, ISSN 0924-0136, Oct. 2022, vol. 308, str. 1-13.

SCIETIFIC MONOGRAPH

POTOČNIK, Primož. Dreaming, waking up and falling into being : a scientist%s adventures and explorations of consciousness. 1st printing. Ljubljana: [samozal.] P. Potočnik, 2022.



PROJECTS

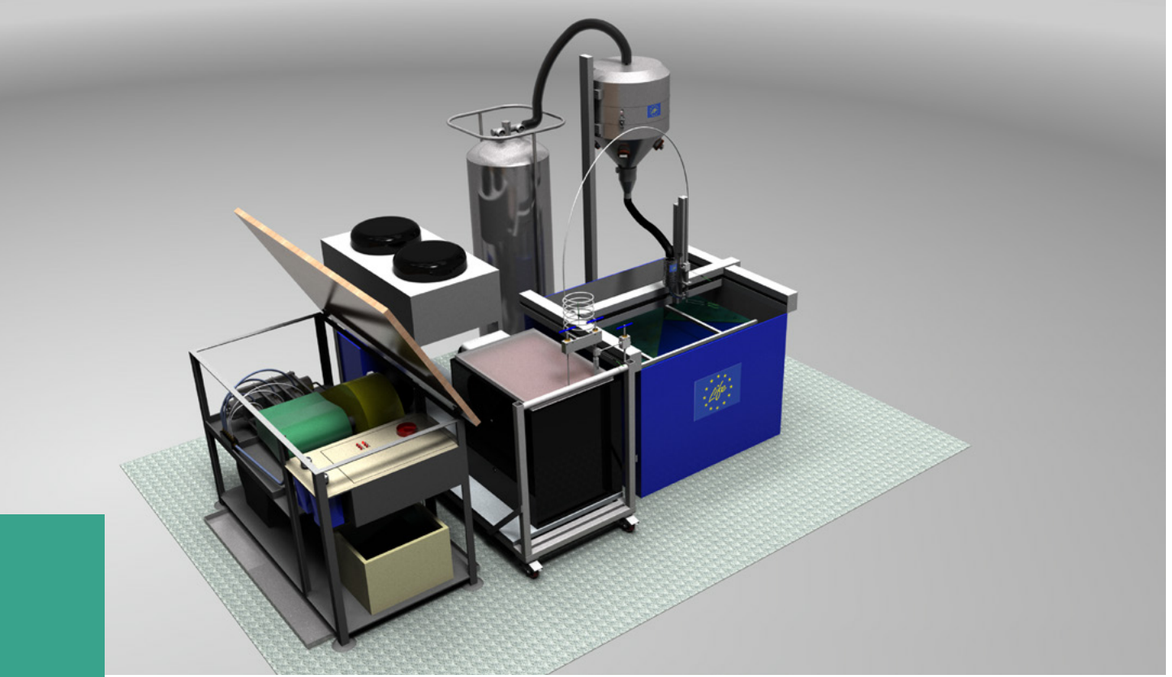
Slovenian Research Agency: BIOAD - Antibacterial alloys: Development by additive 3D manufacturing, characterisation and clinical applications. Edvard Govekar. 2022-2025

08 INNOVATIVE PRODUCTION SYSTEMS AND PROCESSES

The programme group Innovative manufacturing systems is continuing the research work from previous years with its main focus on the Smart factories concept.

The aim is to increase the efficiency and flexibility of manufacturing systems and processes (MSP), based on the principles of the Digital Factory, LEAN, AGILE and TQM and aligned with the Industry 4.0 guidelines. In constructing self-adjusting mechanisms of MSP with defined roles we are focusing on the development of an intelligent algorithm that would automatically suggest optimization steps and solutions. We will apply the above mentioned technologies, related to the Smart Factories concepts, also in the fields of smart forming tools, IceJet cutting, high-dynamic hydraulic positioning axes, intelligent MSP in the domain of assembly and packaging of the consumer products, etc.

In this way we are keeping pace with the evolution and the prospect of manufacturing systems and processes, which extends from the current state of the so-called LEAN manufacturing, through the paradigm of Manufuture to smart factories and further on to the concept of Remote factory.



Laboratory for Alternative Technologies LAT

RESEARCH AREAS

• Non-traditional machining processes • Additive manufacturing and post-processing • Micromanufacturing technologies

DEPARTMENT HEAD Assoc. Prof. Joško Valentinčič, PhD

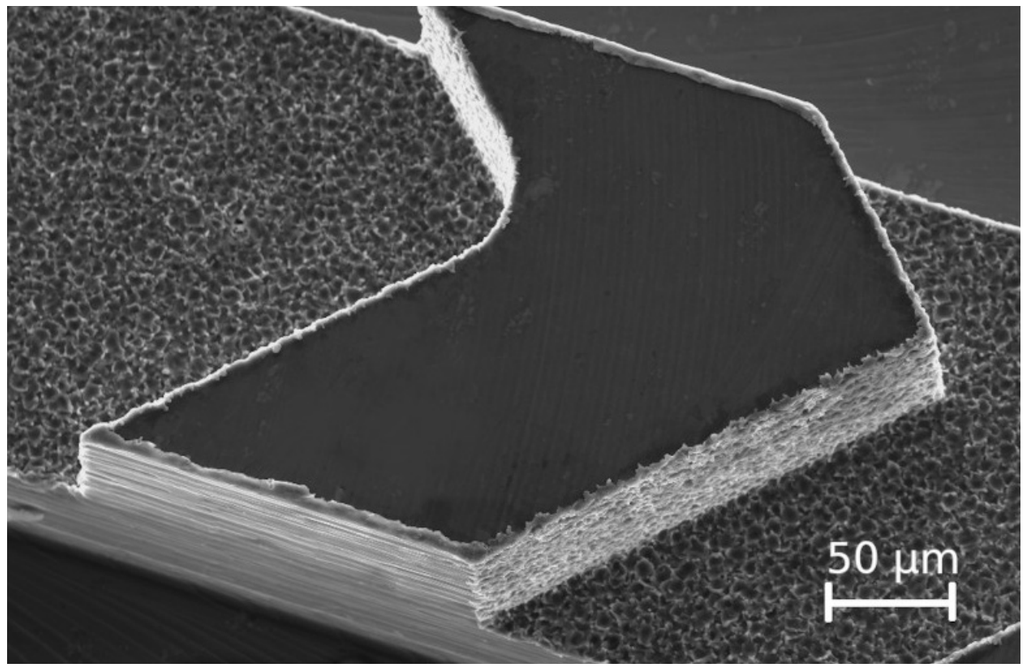
DEPARTMENT MEMBERS Assist. Prof. Andrej Lebar, PhD, Assist. Prof. Henri Orbanić, PhD, Assist. Izidor Sabotin, PhD, Assist. Marko Jerman, PhD, Assist. Suzana Vinetič, Pavel Drešar, Tanja Plestenjak

ORIGINAL SCIENTIFIC ARTICLES

ŠADL, Matej, LEBAR, Andrej, VALENTINČIČ, Joško, URŠIČ NEMEVŠEK, Hana. Flexible energy-storage ceramic thick-film structures with high flexural fatigue endurance. ACS applied energy materials, ISSN 2574-0962, 2022, vol. 5, no. 6, str. 6896-6902.

SABOTIN, Izidor, JERMAN, Marko, LEBAR, Andrej, VALENTINČIČ, Joško, BÖTTGER, Toni, KÜHNEL, Lisa, ZEIDLER, Henning. Effects of plasma electrolytic polishing on SLM printed microfluidic platform. Advanced technologies and materials, ISSN 2620-0325, 2022, vol. 47, nr. 1, str. 19-23.

JERMAN, Marko, ORBANIĆ, Henri, VALENTINČIČ, Joško. CFD analysis of thermal fields for ice abrasive water jet. International journal of mechanical sciences, ISSN 0020-7403, Apr. 2022, vol. 220, str. 1-41.



JOVIČEVIĆ KLUG, Patricia, GUŠTIN, Agnieszka, KLUG JOVIČEVIĆ, Matic, ŠETINA, Barbara, LEBAR, Andrej, PODGORNIK, Bojan. Coupled role of alloying and manufacturing on deep cryogenic treatment performance on high-alloyed ferrous alloys. Journal of Materials Research and Technology, ISSN 2238-7854, 2022, vol. 18, str. 3184-3197.

PROJECTS

Chair Of Micro Process Engineering and Technology – COMPETE. Joško Valentinčič. 1. 9. 2019 – 31. 12. 2024

Forming Laboratory LAP

RESEARCH AREAS

• Theory of plasticity • Forming properties of materials • Forming processes • Biomimetics in forming • Tribology in forming, CARP, CAE, MKE

DEPARTMENT HEAD Assoc. Prof. Tomaž Pepelnjak, PhD

DEPARTMENT MEMBERS Assist. Luka Sevšek, Matjaž Rot, Assist. Ema Stefanovska, Tanja Plestenjak

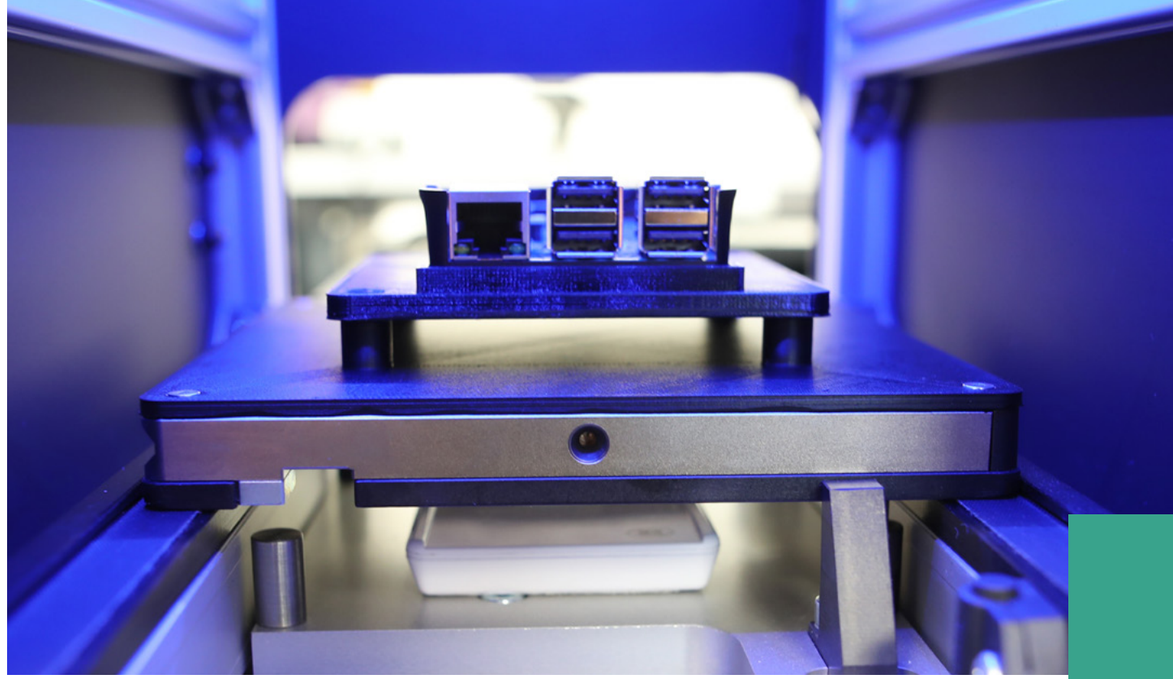
ORIGINAL SCIENTIFIC ARTICLE

STEFANOVSKA, E., PEPELNJAK, Tomaž. Development of a flexible tooling system for sheet metal bending. Advances in production engineering & management, ISSN 1854-6250, Sep. 2022, vol. 17, nr. 3, str. 311%325.

PEPELNJAK, Tomaž, SEVŠEK, Luka, LUŽANIN, Ognjan, MILUTINOVIĆ, Mladomir. Finite element simplifications and simulation reliability in single point incremental forming. Materials, ISSN 1996-1944, 2022, vol. 15, iss. 10, str. 1-22.

PROJECTS

Slovenian Research Agency. Adaptable hardening of austenitic steel surfaces by cryogenic forming processes. Tomaž Pepelnjak. 1.9.2020 - 31.8.2023



Laboratory for Handling, Assembly and Pneumatics LASIM

RESEARCH AREAS

• Handling and assembly • Industry 4.0, smart factories • Discrete simulation • Production logistics • Production resources • Fluid power • Hydraulic and pneumatic control systems and components • Piezo engineering

DEPARTMENT HEAD Prof. Niko Herakovič, PhD

DEPARTMENT MEMBERS Assist. Prof. Marko Šimic, PhD, Assist. Mihael Debevec, PhD, Assist. Miha Pipan, PhD, Assist. Hugo Zupan, PhD, Assist. Matevž Resman, Edo Adrović, Assist. Denis Jankovič, Assist. Maja Turk, Assist. Miha Pippan, PhD, Tanja Plestenjak

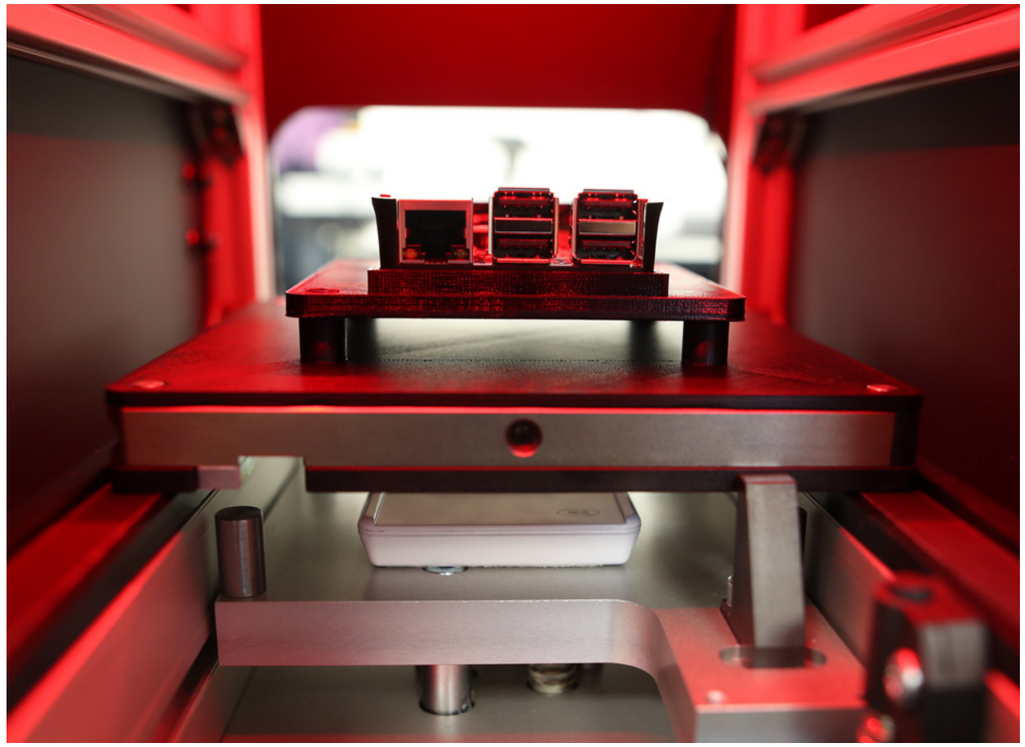
ORIGINAL SCIENTIFIC ARTICLES

TURK, Maja, ŠIMIC, Marko, PIPAN, Miha, HERAKOVIČ, Niko. Multi-criterial algorithm for the efficient and ergonomic manual assembly process. International journal of environmental research and public health, ISSN 1660-4601. [Online ed.], Mar. 2022, vol. 19, iss. 6, str. 1-17.

PROJECTS

Slovenian Research Agency. Research on the reliability and efficiency of edge computing in a smart factory using 5G technologies. Niko Herakovič. 01.10.2022 - 30.09.2025

Horizon Europa. STAGE. Sustainable Transition to the Agile and Green Enterprise. Marko Šimic. 01.06.2022 - 31.05.2025



DOCTORAL DISSERTATION

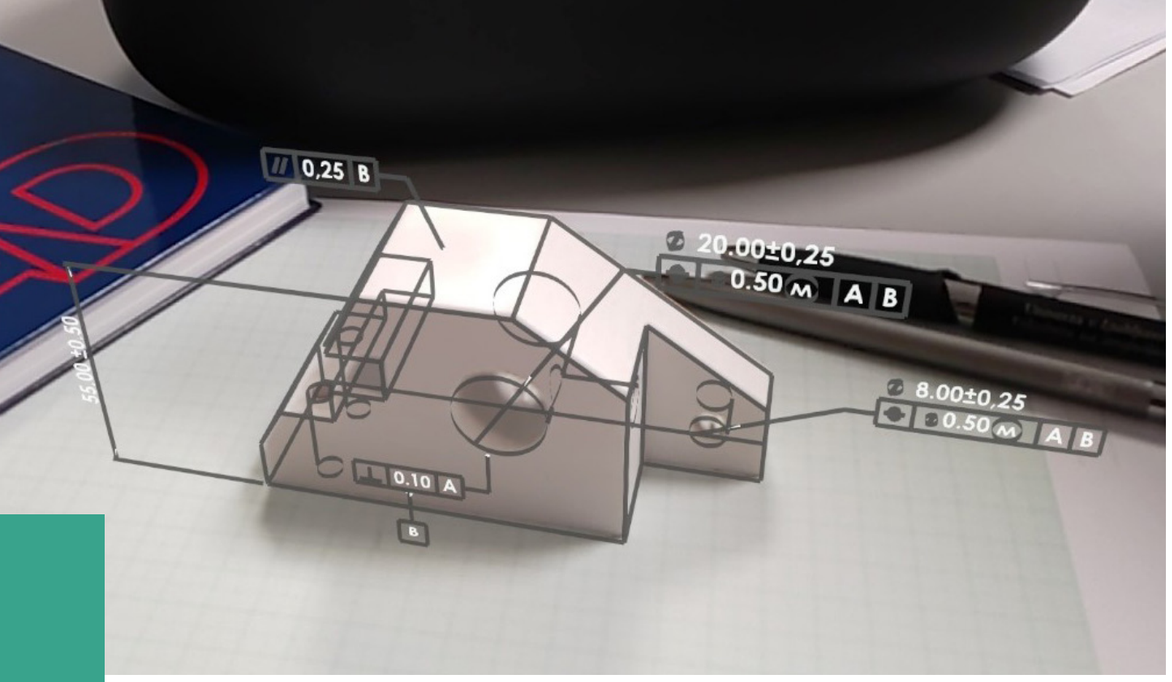
RESMAN, Matevž. Metodologija načrtovanja in snovanja pametnih tovarn na osnovi digitalnih modelov : doktorsko delo. Ljubljana. Mentor: Niko Herakovič

09 ENGINEERING DESIGN

The Engineering design programme group develops basic and applied knowledge needed for the development of new products: design models and methods of innovation, in-depth application of CFX methods, PDM/PLM methods for comprehensive management of information flows in companies, physical/mathematical modelling of polymer gears, and hybrid numerical methods with code development in the field of fusion (ITER) and wider (plasma simulation).

The research was carried out in four basic directions, providing knowledge in the field of design necessary for the innovative development of new products and their implementation. The group has established supercomputing structures in the Slovenian academic environment and is integrated into projects of the supercomputer association PRACE.

Together with domestic and foreign companies (Germany, Japan, China) the group participates in projects in the fields of fusion research (ITER, MSU-USA), auxiliary heart pump (TU Eindhoven and UT Houston) and development of polymer gears and gear trains. The group also implements the model of laboratories, linked to companies.



Laboratory for Engineering Design LECAD

RESEARCH AREAS

Engineering design • ComputerAided Design • Technical information system • Kansei engineering • Polymer gears research • High-Performance Computing • Big data analysis • Computer-intensive methods and applications • Mathematical optimisation • Plasma sheath transition research • Fusion process simulation • Integrated modelling of fusion

DEPARTMENT HEAD Assist. Prof. Nikola Vukašinović, PhD

DEPARTMENT MEMBERS Assoc. Prof. Leon Kos, PhD, Assist. Prof. Janez Benedičič, PhD, Assist. Prof. Damijan Zorko, PhD, Assist. Vanja Čok, PhD, Assist. Ivan Demšar, PhD, Assist. Borut Černe, PhD, Assist. Pavel Tomšič, PhD, Assist. Mojškerc Bor, PhD, Assist. Ivona Vasileska, PhD, Jernej Kovačič, PhD, Stephan Costea, PhD, Matjaž Šubelj, Assist. Matic Brank, Mateja Maffi, Alenka Maffi, Leon Bogdanovič, Renata Piščanec, Prof. Janez Povh, PhD, assist. Prof. Tadej Kanduč, PhD, Assist. Prof. Aleksander Grm, PhD, Assist. Uroš Urbas, PhD, Assist. Timotej Hrga, PhD, Assist. Daria Vlah, Gregor Simič

ORIGINAL SCIENTIFIC ARTICLES

GUSMEROLI, Niccolò, HRGA, Timotej, LUŽAR, Borut, POVH, Janez, SIEBENHOFER, Melanie, WIEGELE, Angelika. BiqBin: a parallel branch-and-bound solver for binary quadratic problems with linear constraints. ACM transactions on mathematical software, ISSN 0098-3500, June 2022, vol. 48, iss. 2, art. 15 (31 str.).

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GYERGYEK, Tomaž, STOPAR, Nik, COSTEA, Stefan, KOVAČIČ, Jernej. Analysis of ion orbits in front of a negative planar electrode immersed in an oblique magnetic field. AIP advances, ISSN 2158-3226, Dec. 2022, iss. 12, 125211, str. 1-18.

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BABIČ, Matej, FRAGASSA, Cristiano, MARINKOVIĆ, Dragan, POVH, Janez. Machine learning tools in the analyze of a bike sharing system. International journal for quality research, ISSN 1800-6450, 2022, vol. 16, no. 2, str. 375-394.

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ČERNE, Borut, BERGANT, Zoran, ŠTURM, Roman, TAVČAR, Jože, ZORKO, Damijan. Experimental and numerical analysis of laminated carbon fibre-reinforced polymer gears with implicit model for coefficient-of-friction evaluation. Journal of computational design and engineering, ISSN 2288-5048, Feb. 2022, vol. 9, iss. 1, str. 246-262.

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ČOK, Vanja, VLAH, Daria, POVH, Janez. Methodology for mapping form design elements with user preferences using Kansei engineering and VDI. Journal of engineering design, ISSN 0954-4828. [Print ed.], 2022, vol. 33, iss. 2, str. 144-170.

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URBAS, Uroš, HRGA, Timotej, POVH, Janez, VUKAŠINOVIĆ, Nikola. Novel alignment method for optical 3D gear metrology of spur gears with a plain borehole. Measurement : journal of the International Measurement Confederation, ISSN 0263-2241. [Print ed.], Mar. 2022, vol. 192, str. 1-10.

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REIMERDES, H., AGOSTINI, M., ALESSI, E., ALBERTI, S., ANDRÈBE, Y., ARNICHAND, H., BALBIN, J., BAGNATO, F., BAQUERO-RUIZ, M., BERNERT, M., GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al. Overview of the TCV tokamak experimental programme. Nuclear fusion, ISSN 0029-5515, Apr. 2022, no. 4, 042018, str. 1-16.

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GRM, Aleksander, PANDA, Satyanand. On the material parameters identification of flexible mooring dolphin. Ocean engineering, ISSN 0029-8018, 2022, vol. 255, str. 1-17.

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MIHELAČ, Lorena, POVH, Janez, WIGGINS, Geraint A. A computational approach to the detection and prediction of (ir)regularity in children's folk songs. Empirical musicology review, ISSN 1559-5749, 2023, vol. 16, no. 2, str. 205-230.

PROJECTS

Erasmus + SCTrain - Supercomputing knowledge partnership. Pavel Tomšič. 01.12.2020 – 30.11.2023

Erasmus + PRO HACKIN' - Product Hackathons for Innovative Development. Nikola Vukašinović 1.11.2021 - 1.11.2024

Erasmus + CResDET - Crisis-Resistant Digital Education and Training. Nikola Vukašinović. 01.04.2021 - 31.03.2023

Horizon H2020 – EUROfusion - Implementation of activities described in the Roadmap to Fusion during Horizon Europe through a joint programme of the members of the EUROfusion consortium. Nikola Vukašinović. 1.1.2021 - 31.12.2025

Horizon H2020 – Prace6IP. PRACE 6th Implementation Phase Project. Janez Povh. 01.05.2019 - 31.12.2022

Horizon H2020 – EUMaster4HPC - European Master for High Performance Computing. Janez Povh. 01.01.2022 - 31.12.2025

ITER - Integrated Modelling Analysis Suite (IMAS). Roman Žavbi. 01.01.2020 - 15.11.2022

Ministry of Agriculture, Forestry and Food. Improvement of the process of animal feeding in dairy and meat production, considering climate change and nature conservation (EIP-AVTO). Janez Benedičič. 01.12.2020 – 30.11.2023

National Competence Centres in the framework of EuroHPC (EUROCC)- Pavel Tomšič. 01.09.2020 - 31.08.2022

Slovenian Research Agency. Fast evaluation of tooth bending fatigue strength of polymer gears. Damijan Zorko. 1. 10. 2021 – 30. 9. 2023

Slovenian Research Agency. Renewable bio-based composite gears – development and performance evaluation using enhanced experimental analyses and numerical simulations. Borut Černe. 1. 10. 2021 – 30. 9. 2023

DOCTORAL DISSERTATION

HRGA, Timotej. Application of semidefinite programming and high-performance computing in discrete optimization : doctoral thesis. Ljubljana: [T. Hrga], 2022. Mentor: Janez Povh

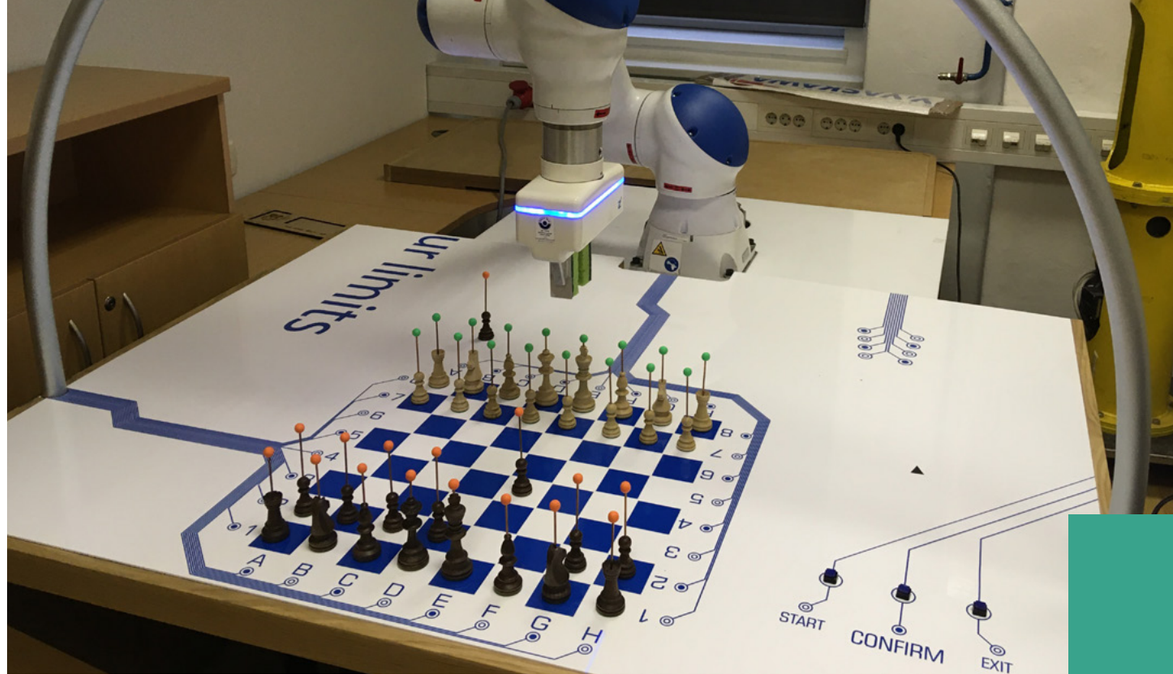
URBAS, Uroš. Metoda analize geometrijske kakovosti zobnikov s primerjavo optičnih meritev in CAD modela : doktorsko delo. Ljubljana: [U. Urbas], 2022. Mentor: Nikola Vukašinović

PATENTS

ZORKO, Damijan, ČERNE, Borut, BERGANT, Zoran. Zobnik iz kompozitnega materiala s kontinuirnimi vlakni : patent SI%26212 A, 2022-12-30. Ljubljana: Urad Republike Slovenije za intelektualno lastnino, 2022.

AWARDS AND ACHIEVEMENTS

Assist. Borut Černe, PhD received an award of the Faculty of Mechanical Engineering for high quality publications.



Laboratory for Material Handling and Machine Structures LASOK

RESEARCH AREAS

• Load-bearing structures • Welded structures • Pressure vessels and pipelines • Lifting and transport devices • Development • Optimisation • Evaluation

DEPARTMENT HEAD Assoc. Prof. Boris Jerman, PhD

DEPARTMENT MEMBERS Assist. Jurij Hladnik, PhD, MSc Franc Resman, Jr. Res. Racaj Fatlind, Renata Piščanec

PROJECTS

Slovenian Research Agency. Warehousing 4.0 – Integration model of robotics and warehouse order-picking systems. Boris Jerman. 1.9.2020 - 31.8.2023

Tajfun Planina d.o.o. - Raziskovalno delo na področju transportnih sredstev in transportnih sistemov. Boris Jerman. 1.1.2022 - 31.12.2024

10 MECHANICS IN ENGINEERING

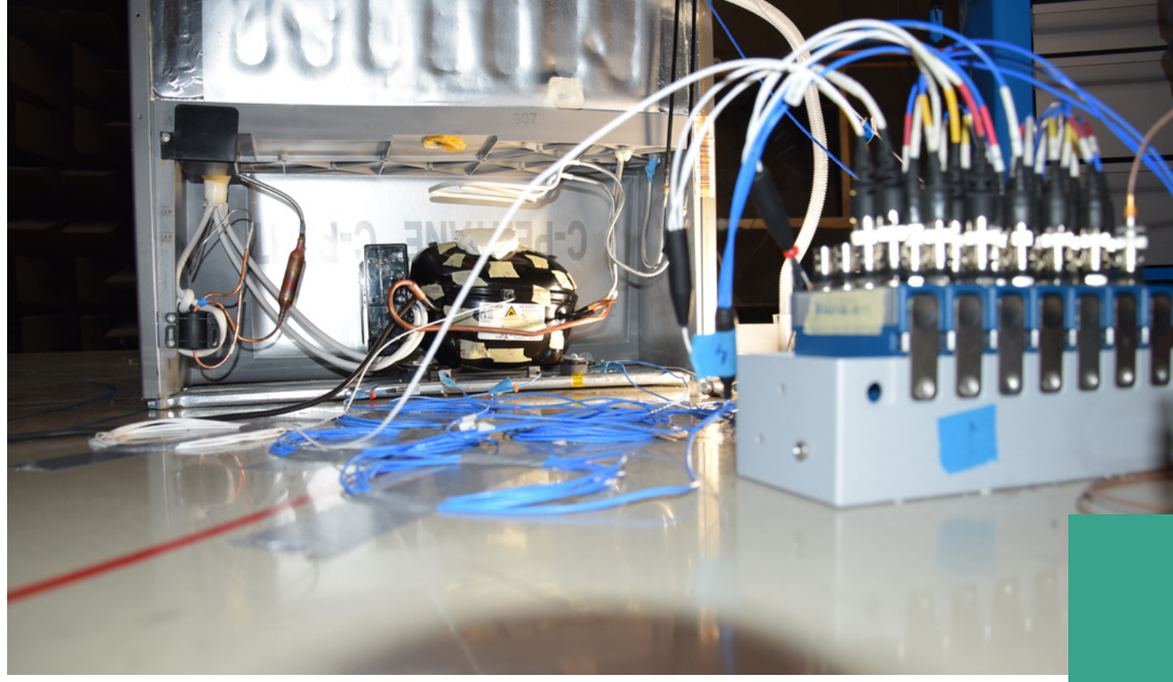
The Mechanics in engineering programme group consists of four laboratories: The Laboratory for Dynamics of Machines and Structures (LADISK), the Laboratory for Numerical Modelling and Simulation (LNMS), the Laboratory for Non-Linear Mechanics (LANEM) and the Laboratory for aeronautics (AEROL).

LADISK: Within the context of flexible multibody system dynamics, the research is focused on advanced methods of valid nonlinear dynamics modelling of rigid-flexible multibody systems with unilateral contacts or large displacements/deformations. In the field of structural dynamics, the group is focused on management of vibration fatigue and product noise. Here, the main emphasis is on research into valid models. Research activities are also geared toward smart structures with sensing function and the development of advanced optical methods for identifying dynamic parameters of structures.

LNMS: Long-term research activities are related to the constitutive modelling of the metallic materials response and the development of numerical methods in this field, whereby the numerical aspect of an effective integration of developed algorithms into the FEM programs is crucial. The more complex constitutive models also require the development of algorithms for inverse identification of model parameters.

LANEM: The theory of elasticity and thermoelasticity, geometric and material nonlinearities, stability, fluid mechanics, inelastic deformation, materials with shape memory, characterization of mechanical properties of materials, biomechanics.

AEROL: Development of unmanned aerial vehicles and systems, research into the possibility of controlling unmanned aerial vehicles using cameras and ground landmarks in areas without the GPS signal, aircraft calculation, calculation and measurement of resistance, lift and torque of aerodynamic bodies, measurement of aerodynamic properties and airflow around bodies in the wind tunnel, construction and testing components related to firearms, modelling and mold making for the manufacture of composite parts of unmanned aerial vehicles.



Laboratory for Dynamics of Machines and Structures LADISK

RESEARCH AREAS

• Mechanics • Dynamics • Dynamics of machines and structures
• Structural dynamics • Vibration fatigue • Mechanical vibrations
• Nonlinear vibrations • Dynamics of rigid and flexible multibody systems • Structure-borne noise • Signal processing (CWT, HOS)
• Rotor dynamics • Automatic fault detection in mechanical systems
• Dynamics of moving continua • Digital image correlation methods

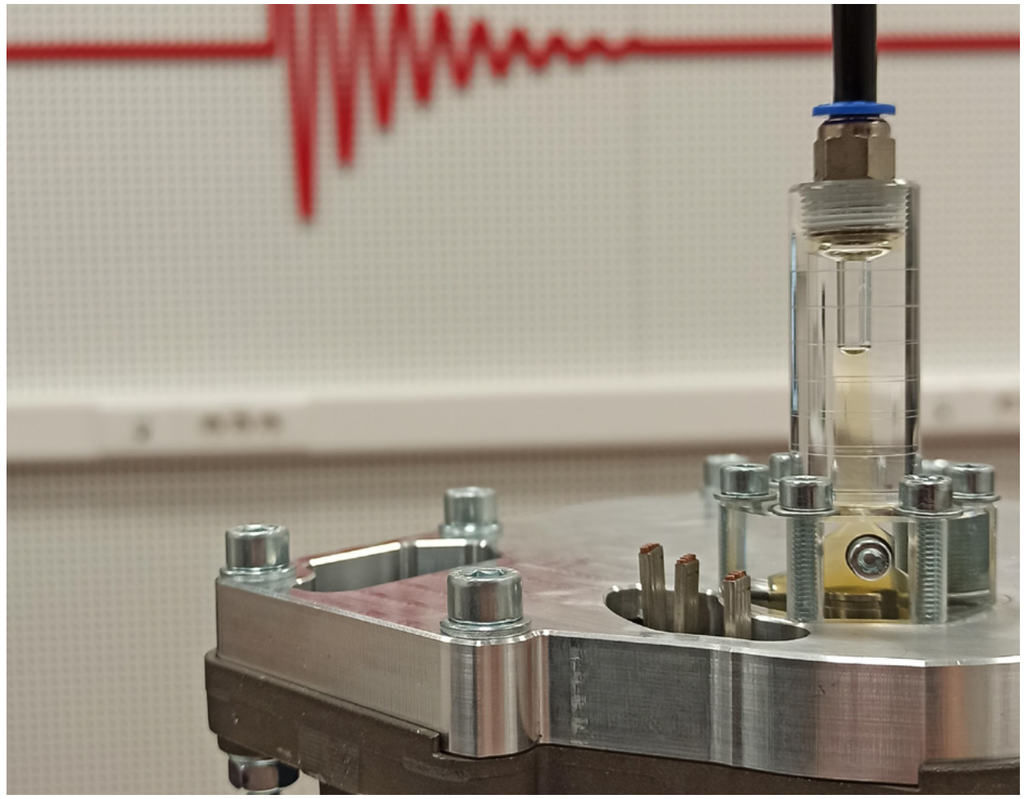
DEPARTMENT HEAD Prof. Miha Boltežar, PhD

DEPARTMENT MEMBERS Prof. Janko Slavič, PhD, Assoc. Prof. Gregor Čepon, PhD, Assist. Prof. Martin Česnik, PhD, Vitoslav Bratuš, PhD, Assist. Aleš Mihelič, PhD, Assist. Tibor Barši Palmić, Assist. Miha Kodrič, Assist. Miha Pogačar, Assist. Domen Gorjup, Assist. Klemen Zaletelj, Assist. Martin Furlan, PhD, Assist. Domen Ocepek, Assist. Aleš Zorman, Assist. Tilen Košir, Gašper Krivic, Assist. Ivan Tomac, PhD, Assist. Tim Vrtač, Assist. Jure Korbar, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

KOŠIR, Tilen, SLAVIČ, Janko. Single-process fused filament fabrication 3D-printed high-sensitivity dynamic piezoelectric sensor. Additive manufacturing, ISSN 2214-8604. [Print ed.], Jan. 2022, vol. 49, str. 1-9.

ARH, Matic, SLAVIČ, Janko. Single-process 3D-printed triaxial accelerometer. Advanced materials technologies, ISSN 2365-709X, 2022, vol. 7, iss. 7, str. 1-7.



BARŠI PALMIĆ, Tibor, SLAVIČ, Janko. Single-process 3D-printed stacked dielectric actuator. International journal of mechanical sciences, ISSN 0020-7403, Sep. 2022, vol. 230, str. 1-14.

BREGAR, Tomaž, EL MAHMOUDI, Ahmed, KODRIČ, Miha, OCEPEK, Domen, TRAINOTTI, Francesco, POGAČAR, Miha, GÖLDELI, Mert, ČEPON, Gregor, BOLTEŽAR, Miha, RIXEN, Daniel J. pyFBS : a Python package for frequency based substructuring. Journal of open source software, ISSN 2475-9066, Jan. 2022, vol. 7, no. 69, str. 1-4.

OCEPEK, Domen, ČEPON, Gregor, BOLTEŽAR, Miha. Characterization of sensor location variations in admittance-based TPA methods. Journal of sound and vibration, ISSN 0022-460X. [Print ed.], Jun. 2022, vol. 528, str. 1-15.

OBLAK, Miša, PIRNAT, Miha, BOLTEŽAR, Miha. Modal-interaction approach to the strong structural-acoustic coupling of an elastic Helmholtz resonator and an acoustic cavity containing a heavy fluid. Journal of sound and vibration, ISSN 0022-460X. [Print ed.], Sep. 2022, vol. 535, str. 1-17.

KODRIČ, Miha, BREGAR, Tomaž, ČEPON, Gregor, BOLTEŽAR, Miha. An expansion based on system equivalent model mixing : from a limited number of points to a full-field dynamic response. Measurement : journal of the International Measurement Confederation, ISSN 0263-2241. [Print ed.], Feb. 2022, vol. 190, str. 1-13.

POGAČAR, Miha, ČEPON, Gregor, BOLTEŽAR, Miha. Weakening of the multi-point constraints in modal substructuring using singular value decomposition. Mechanical systems and signal processing, ISSN 0888-3270, 15. jan. 2022, vol. 163, str. 1-17.

ZALETELJ, Klemen, SLAVIČ, Janko, BOLTEŽAR, Miha. Full-field DIC-based model updating for localized parameter identification. Mechanical systems and signal processing, ISSN 0888-3270, 1. Feb. 2022, vol. 164, str. 1-14.

TOMAC, Ivan, SLAVIČ, Janko. Damping identification based on a high-speed camera. Mechanical systems and signal processing, ISSN 0888-3270, Mar. 2022, vol. 166, str. 1-12.

ČEPON, Gregor, OCEPEK, Domen, KORBAR, Jure, BREGAR, Tomaž, BOLTEŽAR, Miha. Sensitivity-based characterization of the bias errors in frequency based substructuring. Mechanical systems and signal processing, ISSN 0888-3270, May 2022, vol. 170, str. 1-18.

POGAČAR, Miha, OCEPEK, Domen, TRAINOTTI, Francesco, ČEPON, Gregor, BOLTEŽAR, Miha. System equivalent model mixing : a modal domain formulation. Mechanical systems and signal processing, ISSN 0888-3270, Sept. 2022, vol. 177, str. 1-18.

PROJECTS

Slovenian Research Agency. Hybrid Dynamic Substructuring in the Industry of Home Appliances. Miha Boltežar. 1.7.2019 – 30.6.2022

Slovenian Research Agency. High-speed-camera based high-spatial-density sensing of 3D vibrations with applications in digital-twins and remote sensing. Janko Slavič. 1.7.2019 – 30.6.2022

Slovenian Research Agency. Vision based reduced order modeling approach for operational parameter identification of nonlinear finite element models. Miha Boltežar. 1.1.2020 - 31.12.2023

Obzorje 2020. NOn-contact STRucturAl DAMage for fUture Safety and lightweight. Janko Slavič. 1. 10. 2021 – 30. 9. 2023

Slovenian Research Agency. Single-Process Fused Filament Fabrication 3D-Printed Piezoelectric Sensor. Janko Slavič. 1. 10. 2021 – 30. 9. 2024

Company Gorenje - Research development cooperation and lease of capacities for numerical analyses and performance of measurements and tests. Gregor Čepon. 27. 6. 2021 – 26. 6. 2023

PATENTS

BOLKA, Špela, BRATUŠ, Vitoslav, BERGOČ, Ines, JERMAN, Ivan, ČOLOVIĆ, Marija, RODOŠEK, Mirjana. Method for the production of a laminated coree : United States Patent US 11,384,258 B2, 2022-07-12. Alexandria: United States Patent and Trademark Office, 2022.

DOCTORAL DISSERTATION

GORJUP, Domen. Identifikacija prostorskih obratovalnih oblik nihajočih struktur z uporabo samo ene hitre kamere : doktorsko delo. Mentor: Janko Slavič

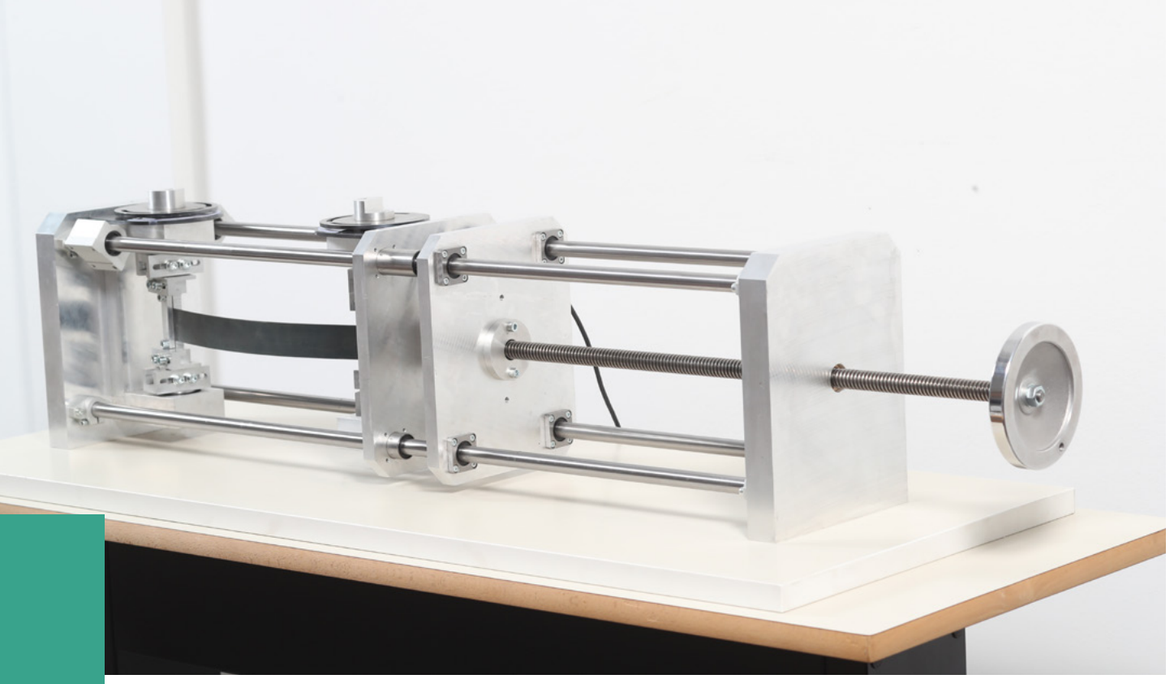
POGAČAR, Miha. Karakterizacija dinamskih lastnosti prožnih povezav v eksperimentalnem modalnem podstrukturiranju : dissertation. Mentor: Gregor Čepon

AWARDS AND ACHIEVEMENTS

Assist. Tibor Barši Palmić, assist. Miha Pogačar, PhD, assist. Klemen Zaletelj and assist. Domen Ocepek received an award of the Faculty of Mechanical Engineering for high quality publications.

On the World Teachers' Day, Prof. Miha Boltežar, PhD received the Award of the Republic of Slovenia for his lifetime achievement in higher education.

MECHANICS IN ENGINEERING



Laboratory for Non-Linear Mechanics LANEM

RESEARCH AREAS

Nonlinear mechanics • Stability • Mechanics of materials • Materials with shape memory

DEPARTMENT HEAD Assist. Prof. Miha Brojan, PhD

DEPARTMENT MEMBERS Assist. Matjaž Čebron, PhD, Assist. Jan Zavodnik, Jonas Trojer, Assist. Tomaž Brzin, Assist. Enej Istenič, Assist. Damjan Lolić, PhD, Assist. Aljaž Robek, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

RAHMANI, Ramin, MOLAN, Katja, BROJAN, Miha, PRASHANTH, Konda Gokuldoss, STOPAR, David. High virucidal potential of novel ceramic%metal composites fabricated via hybrid selective laser melting and spark plasma sintering routes. International journal of advanced manufacturing technology, ISSN 0268-3768, 2022, vol. 120, str. 975-988.

RAHMANI, Ramin, KAMBOJ, Nikhil, BROJAN, Miha, ANTONOV, Maksim, PRASHANTH, Konda Gokuldoss. Hybrid metal-ceramic biomaterials fabricated through powder bed fusion and powder metallurgy for improved impact resistance of craniofacial implants. Materialia, ISSN 2589-1529, 2022, vol. 24, str. 1-12.

ISTENIČ, Enej, ŠAJN, Viktor, BROJAN, Miha. Influence of surface properties on the dynamics of fluid flow. Physics of fluids, ISSN 1070-6631, 2022, vol. 34, iss. 2, str. 1-17.

MOLAN, Katja, RAHMANI, Ramin, KRKLEC, Daniel, BROJAN, Miha, STOPAR, David. Phi 6 bacteriophage inactivation by metal salts, metal powders, and metal surfaces. Viruses, ISSN 1999-4915, 2022, vol. 14, iss. 2, str. 1-12.

PROJECTS

Slovenian Research Agency. Development of quasi-periodic deformation patterns in viscoelastic structures. Miha Brojan. 1.9.2020 - 31.8.2023

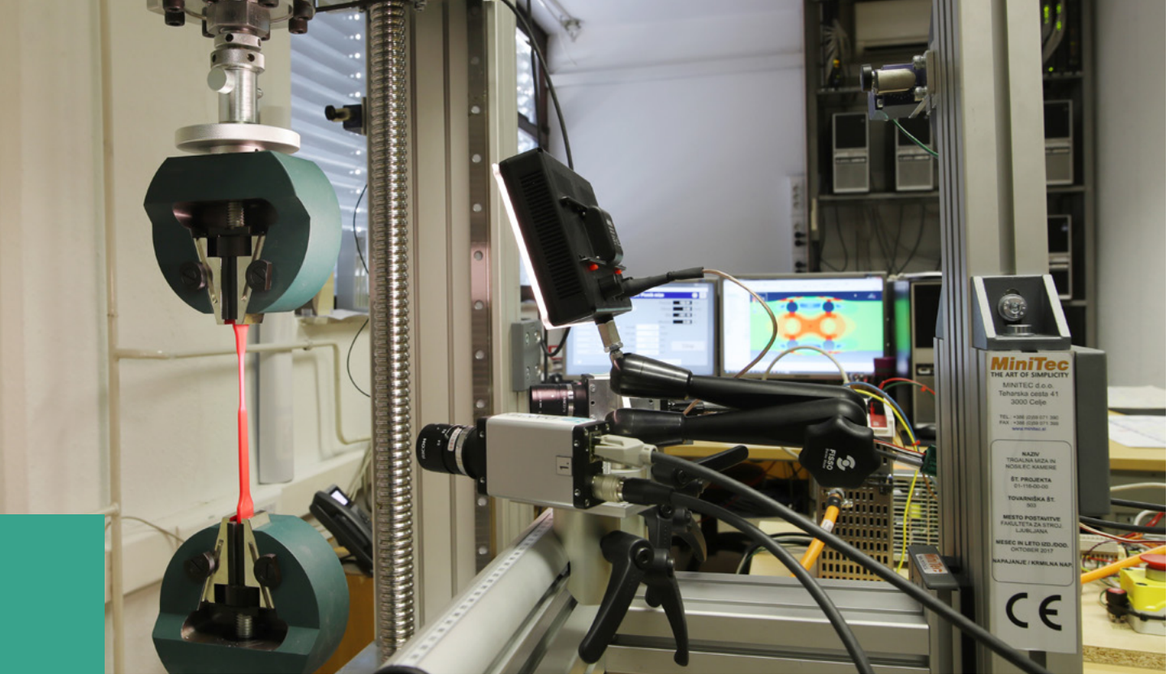
Slovenian Research Agency. Morphing soft kirigami composite system for the design of flexible deployables and soft-robots. Miha Brojan. 01.10.2022 - 30.09.2025

Erasmus + LiDeSuM- Lightweight Design for Sustainable Mobility. Miha Brojan. 01.10.2022 - 31.12.2023

DOCTORAL DISSERTATION

VELDIN, Tomo. Končni elementi za simulacijo gubanja tankih lupin na elastičnih substratih : doktorsko delo. Mentor: Miha Brojan

PORENTA, Luka. Stabilnost superelastičnih tankostenskih lupin iz materiala z oblikovnim spominom za uporabo v elastokalorični tehnologiji : doktorsko delo. Mentor: Miha Brojan



Laboratory for Numerical Modelling and Simulation LNMS

RESEARCH AREAS

Mechanics • Numerical methods • Computer simulations of technological processes • Modelling of thermomechanical processes • Optimisation of products and processes • Nuclear engineering • Constitutive modelling • Electromagnetism • Finite element method and boundary element method

DEPARTMENT HEAD Assist. Prof. Miroslav Halilovič, PhD

DEPARTMENT MEMBERS Assoc. Prof. Nikolaj Mole, PhD, Assist. Prof. Pino Koc, PhD, Assist. Kristjan Krebelj, PhD, Assist. Primož Rus, PhD, Assist. Prof. Bojan Starman, PhD, Assist. Janez Urevc, PhD, MSc Andrej Kotar, Assist. Štefan Obid, Assist. Tomaž Kastelic, Assist. Andraž Maček, PhD, Assist. Dejan Kovšca, Assist. Rok Markežič, Assist. Maček Andraž, PhD., Bergauer Andrej, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

KARIMI, Ako, MOLE, Nikolaj, PEPELNJAK, Tomaž. Numerical investigation of the cycling loading behavior of 3D-Printed poly-lactic acid (PLA) cylindrical lightweight samples during compression testing. Applied sciences, ISSN 2076-3417, Aug. 2022, vol. 12, iss. 16, str. 1-18.

KASTELIC, Tomaž, STARMAN, Bojan, CAFUTA, Gašper, HALILOVIČ, Miroslav, MOLE, Nikolaj. Correction of mould cavity geometry for warpage compensation. International journal of advanced manufacturing technology, ISSN 0268-3768, Nov. 2022, vol. 123, str. 1957%1971.

NABERGOJ, Matija, UREVC, Janez, HALILOVIČ, Miroslav. Function-based reconstruction of the fiber orientation distribution function of short-fiber-reinforced polymers. Journal of rheology, ISSN 0148-6055, Jan. 2022, vol. 66, iss. 1, str. 1-32.

MARKEŽIČ, Rok, MOLE, Nikolaj, NAGLIČ, Iztok, MARKOLI, Boštjan, ŠTURM, Roman. Napovedovanje spreminjanje trdote orodij med procesom tlačnega litja = Tool hardness change prediction during high pressure die casting process. Livarski vestnik : glasilo Društva livarjev Slovenije, ISSN 0024-5135, 2022, letn. 69, št. 2, str. 111-119.

UNIVERSITY, HIGER EDUCATION OR SHORT-TERM HIGER EDUCATION TEXTBOOK WITH REVIEW

HALILOVIČ, Miroslav, UREVC, Janez, STARMAN, Bojan. Osnove statike in trdnosti s preprostimi in nazornimi poskusi : delovni učbenik za Statiko in trdnost. 4. izd. Ljubljana: Fakulteta za strojništvo, 2022.

PROJECTS

Slovenian Research Agency. Development of technical guidelines for quadruple glazing . Miroslav Halilovič. 1. 10. 2021 – 30. 9. 2024

MECHANICS IN ENGINEERING

Laboratory for aeronautics AEROL

RESEARCH AREAS

Construction mechanics • Special development know-how • Special constructions know-how

DEPARTMENT HEAD Prof. Franci Pušavec, PhD

DEPARTMENT MEMBERS Assist. Igor Petrović, PhD, Assist. Peter Pipp, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLE

PETROVIĆ, Igor, SEČNIK, Matej, HOČEVAR, Marko, BERK, Peter. Vine canopy reconstruction and assessment with terrestrial lidar and aerial imaging. Remote sensing, ISSN 2072-4292, 2022, vol. 14, iss. 12, str. 1-23.

AWARDS AND ACHIEVEMENTS

Assist. Igor Petrović, PhD received an award of the Faculty of Mechanical Engineering for excellence in teaching.

11 SUSTAINABLE POLYMER MATERIALS AND TECHNOLOGIES

The Sustainable polymer materials and technologies programme group covers basic research on non-linear time-dependent behaviour of polymers and their composites which are regarded as dissipative systems. The programme is divided into three complementary research spheres:

SPHERE 1: Study of the structure-property relationship in polymeric materials (without changing their chemical composition) and the means of controlling their inherent topological structure. This allows us to control their physical properties and, consequently, to fit properties of polymeric materials to a particular application.

SPHERE 2: Development of experimental methods for analyzing dissipative time-dependent behaviour of materials that will allow characterisation and prediction of the durability of products made of polymeric materials.

SPHERE 3: Development of theoretical models and numerical tools which, together with new experimental methods, can be used to predict the mechanical behaviour of polymers and their nano-, micro-, and macrocomposites over a longer period of time.

Laboratory for Experimental Mechanics LEM

RESEARCH AREAS

Polymers • Composites • Nanomaterials • Time-dependent behaviour of materials • Experimental mechanics • Modelling of mechanical properties of materials • Technology of polymer processing • Material structure formation

DEPARTMENT HEAD Assist. Prof. Lidija Slemenik Perše, PhD

DEPARTMENT MEMBERS PhD, Assist. Marko Bek, PhD, Assist. Mohor Mihelčič, PhD, Assist. Alen Oseli, PhD, Assist. Urška Gradišar Centa, PhD, Assist. Andrii Vakulka, PhD, Jr. Res. Sadaf Mahrukh, Matic Šobak, Jr. Res Serafimoski Stefan, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

GRADIŠAR CENTA, Urška, MIHELČIČ, Mohor, BOBNAR, Vid, REMŠKAR, Maja, SLEMENIK PERŠE, Lidija. The effect of PVP on thermal, mechanical, and dielectric properties in PVDF-HFP/PVP thin film. Coatings, ISSN 2079-6412, Aug. 2022, vol. 12, iss. 9, str. 1-10.

OPARA KRAŠOVEC, Urša, VIDMAR, Tjaša, KLANJŠEK GUNDE, Marta, CERC KOROŠEC, Romana, SLEMENIK PERŠE, Lidija. In-depth rheological characterization of tungsten sol-gel inks for inkjet printing. Coatings, ISSN 2079-6412, 2022, vol. 12, iss. 2, 15 str.

MIHELČIČ, Mohor, KLANJŠEK GUNDE, Marta, SLEMENIK PERŠE, Lidija. Rheological behavior of spectrally selective coatings for polymeric solar absorbers. Coatings, ISSN 2079-6412, Mar. 2022, vol. 12, iss. 3, str. 1-15.

RŽEK, Lidija, TUŠAR, Marjan, SLEMENIK PERŠE, Lidija. Modelling rheological characteristics of rejuvenated aged bitumen. The International journal of pavement engineering, ISSN 1029-8436, 2022, vol. 23, iss. 4, str. 1282-1294.

VAKULKA, Andrii, GORESHNIK, Evgeny A., JAGODIČ, Marko, JAGLIČIĆ, Zvonko, TRONTELJ, Zvonko. Tetrahydrated bis(monoaqua-bis(ethylenediamine) copper(II))-diaqua-bis(ethylenediamine)copper(II) dicitrate : preparation, crystal structure, Raman and FTIR spectra and paramagnetic behavior. Journal of coordination chemistry, ISSN 1029-0389, 2022, vol. 75, iss. 15/16, str.

BEK, Marko, AULOVA, Alexandra, PUŠNIK ČREŠNAR, Klementina, MATKOVIČ, Sebastjan, KALIN, Mitjan, SLEMENIK PERŠE, Lidija. Long-term creep compliance of wood polymer composites: using untreated wood fibers as a filler in recycled and neat polypropylene matrix. Polymers, ISSN 2073-4360, June 2022, vol. 14, iss. 13 (2539), 19 str.

SADAF, Mahrukh, CANO, Santiago, GONZALEZ-GUTIERREZ, Joamin, BRAGAGLIA, Mario, SCHUSCHNIGG, Stephan, KUKLA, Christian, HOLZER, Clemens, VÁLY, Lilla, KITZMANTEL, Michael, NANNI, Francesca. Influence of binder composition and material extrusion (MEX) parameters on the 3D printing of highly filled copper feedstocks. Polymers, ISSN 2073-4360, Nov. 2022, vol. 14, iss. 22, str. 1-21.

MIHELČIČ, Mohor, OSELI, Alen, HUSKIĆ, Miroslav, SLEMENIK PERŠE, Lidija. Influence of stabilization additive on rheological, thermal and mechanical properties of recycled polypropylene. Polymers, ISSN 2073-4360, Dec. 2022, vol. 14, iss. 24, str. 1-

ŠTIRN, Žiga, ČOLOVIĆ, Marija, VASILJEVIĆ, Jelena, ŠOBAK, Matic, ŽITKO, Gregor, ČELAN KOROŠIN, Nataša, SIMONČIČ, Barbara, JERMAN, Ivan. Effect of bridged DOPO/polyurethane nanocomposites on solar absorber coatings with reduced flammability. Solar energy, ISSN 0038-092X. [Print ed.], 1 Jan. 2022, vol. 231, str. 104-114.

PROJECTS

Slovenian Research Agency. Sustainable polymer materials and technologies. Lidija Slemenik Perše. 1. 1. 2020 - 31. 12. 2025

Slovenian Research Agency. Sustainable use of polymers in home appliances - Prediction of long-term viscoelastic behavior. Lidija Slemenik Perše. 1. 10. 2021 - 30. 9. 2024

DOCTORAL DISSERTATION

SADAF, Mahrukh. Additive manufacturing of metals via material extrusion : Ph.D. program in Design, Manufacturing, and Operation Engineering. Roma: [M. Sadaf], 2022.

SUSTAINABLE POLYMER MATERIALS AND TECHNOLOGIES

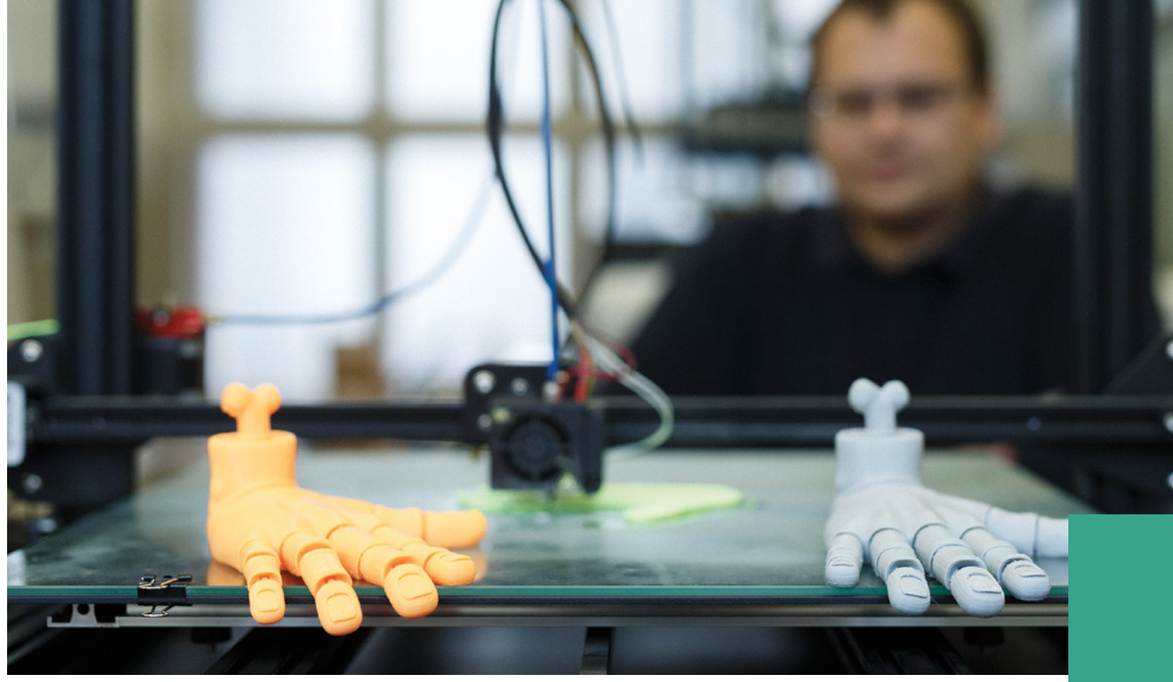
12 ADVANCED MANUFACTURING TECHNOLOGIES FOR HIGH QUALITY AND SUSTAINABLE PRODUCTION

Slovenian industry has a significant impact on the development of economy, employment, innovations and export. A large part of the economy depends on the competitiveness of the manufacturing industry. Thus, the concept of rapid production, innovative machining technologies, manufacturing technology management and the idea of sustainable development are becoming key research areas for increasing the competitiveness of the Slovenian processing industry.

Long-term research content focuses on the development, transfer and research support of high-performance machining technologies (cutting, 3D printing, etc.), including the implementation of sustainable development considerations in manufacturing technologies in response to environmental, social and economic challenges. The focus is not limited to innovations in technology, but also on providing integrated development solutions.

The research domains of the programme group are complementary, and to a certain extent interdisciplinary, comprised of:

- advanced machining processes;
- technology and resource efficiency;
- quality engineering for manufacturing;
- human-centered manufacturing.



Laboratory for Cutting LABOD

RESEARCH AREAS

Technology and product planning • Sustainable development of machining processes • Research of machining processes • Development of new machining processes (cryogenic machining, the novel dry machining) • Characterisation of material machinability • High-speed hard milling for the tool industry • Machine tools • Machining process sensors • Reverse engineering • 3D prototype printing • Characterisation of machining surface quality • Product precision and accuracy

DEPARTMENT HEAD Prof. Franci Pušavec, PhD

DEPARTMENT MEMBERS Assoc. Prof. Peter Krajnik, PhD, Res. Assoc. Radovan Dražumerič, PhD, Assist. Awais Ikram, PhD, Assist. Jaka Dugar, Assist. Matjaž Kern, Vinko Rotar, Assist. Luka Sterle, Assist. Deepa Kareepadath Santhos, Rodriguez Bogajo Iñigo, Marija Jeretina

ORIGINAL SCIENTIFIC ARTICLES

RODRIGUEZ, Iñigo, ARRAZOLA, Pedro J., CUESTA, Mikel, STERLE, Luka, PUŠAVEC, Franci. Improving surface integrity when drilling CFRPs and Ti-6Al-4V using sustainable lubricated liquid carbon dioxide. Chinese journal of aeronautics, ISSN 1000-9361, 2022, str. 1-18, ilustr.

MACEROL, Nastja, FRANCA, Luiz, ATTIA, Helmi, KRAJNIK, Peter. A lapping-based test method to investigate wear behaviour of bonded-abrasive tools. CIRP annals, ISSN 0007-8506, 2022, vol. 71, iss. 1, str. 305-308.

DRAŽUMERIČ, Radovan, BADGER, Jeffrey A., GUSTAVSSON, Tomas, KRAJNIK, Peter. Mechanics of self-rotating double-disc grinding process. CIRP annals, ISSN 0007-8506, 2022, vol. 71, iss. 1, str. 309-312.

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MACEROL, Nastja, FRANCA, Luiz, DRAŽUMERIČ, Radovan, KRAJNIK, Peter. The effects of grit properties and dressing on grinding mechanics and wheel performance : analytical assessment framework. International journal of machine tools & manufacture, ISSN 0890-6955. [Print ed.], Sep. 2022, vol. 180, str. 1-13.

HOIER, Philipp, AZARHOUSHANG, Bahman, LUNDIN, Per, MALAKIZADI, Amir, BADGER, Jeffrey A., STORMVINTER, Albin, BJÖRK, Thomas, KLEMENT, Uta, HASHIMOTO, Fukuo, KRAJNIK, Peter. Influence of batch-to-batch material variations on grindability of a medium-carbon steel. Journal of manufacturing processes, ISSN 1526-6125. [Print ed.], Jan. 2022, vol. 73, str. 463-470.

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KHANNA, Navneet, SHAH, Prassan, SARIKAYA, Murat, PUŠAVEC, Franci. Energy consumption and ecological analysis of sustainable and conventional cutting fluid strategies in machining 15%5 PHSS. Processes, ISSN 2227-9717.

PROJECTS

ERASMUS + REACH - Reinforcing Access to Cross Border Employment at Palestinian Higher Education Institutions –PHEIs. Franci Pušavec. 15.11.2019 - 14.11.2022

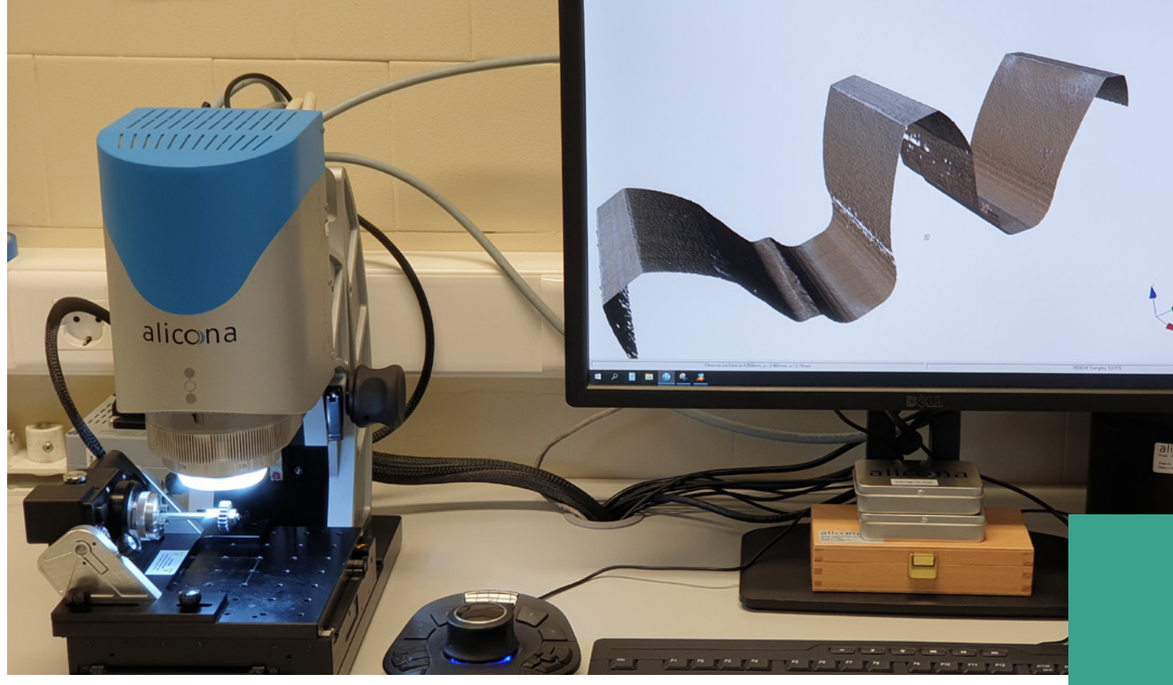
Slovenian Research Agency. Development and implementation of innovative machining technology for machining ZnO based ceramics with defined cutting geometry, in serial production, to increase the quality of varistors as final products. Franci Pušavec. 1.7.2019 – 30.6.2022

EIT Manufacturing. Transitioning to a waste-free production – international cryogenic+MQL machining activity. Franci Pušavec. 1. 3. 2021 – 31. 12. 2022

EIT Hybrid learning paths for professional education in manufacturing | PATHFINDER. Franci Pušavec. 01.01.2022 - 31.12.2022Slovenian Research Agency. Research and development of innovative manufacturing technologies for hydrogen fuel cell production for green mobility. Damir Grguraš. 01.10.2022 - 30.09.2024

DOCTORAL DISSERTATION

STERLE, Luka. Fundamental characterization of cryogenic machining by applying solid lubricants : dissertation. Mentor: Franci Pušavec



Laboratory for Quality Assurance LAZAK

RESEARCH AREAS

Quality planning and control • Quality assurance of processes, products and services • Technology and innovation management • 3D digitisation and reverse engineering • Machine tools precision and accuracy measurement

DEPARTMENT HEAD Assoc. Prof. Davorin Kramar, PhD

DEPARTMENT MEMBERS Assist. Damir Grguraš, PhD, Assist. Luka Kastelic, Marija Jeretina

ORIGINAL SCIENTIFIC ARTICLES

TEŠIĆ, Saša, CICA, Djordje, BOROJEVIĆ, Stevo, SREDANOVIĆ, Branislav, ZELJKOVIĆ, Milan, KRAMAR, Davorin, PUŠAVEC, Franci. Optimization and prediction of specific energy consumption in ball-end milling of Ti-6Al-4V alloy under mql and cryogenic cooling/ lubrication conditions. International journal of precision engineering and manufacturing, Green engineering, ISSN 2198-0810, Nov. 2022, iss. 9, str.

MUŽENIČ, David, KRAMAR, Davorin, PUŠAVEC, Franci. Advances in understanding of damage formation during laser-assisted milling of ZnO-based varistor ceramics. Journal of manufacturing processes, ISSN 1526-6125. [Print ed.], Dec. 2022, vol. 84, str.

ADVANCED MANUFACTURING TECHNOLOGIES FOR HIGH QUALITY AND SUSTAINABLE PRODUCTION

13 PRODUCTION SYSTEMS, LASER TECHNOLOGIES AND MATERIALS WELDING - PLAS

The research programme Production systems, laser technologies and materials welding integrates four research fields which are of key importance for the development of modern manufacturing.

The Production systems field focuses on:

- concepts of distributed manufacturing systems, including their structuring and control;
- concurrent product development concepts;
- principles of product-service systems, on-line monitoring and remote control;
- development of mechatronics and cyber-physical systems applications.

The research in the Laser systems field is aimed at:

- Fiber and hybrid laser sources, and pulsed laser sources;
- laser measuring systems for simultaneous 3D shape and color measurement of bodies in real time;
- adaptive control of laser systems based on identification, monitoring and adaptive process control;
- opto-mechatronic systems based on optical elements with free surfaces, electrically focus-tunable lenses and microlens arrays.

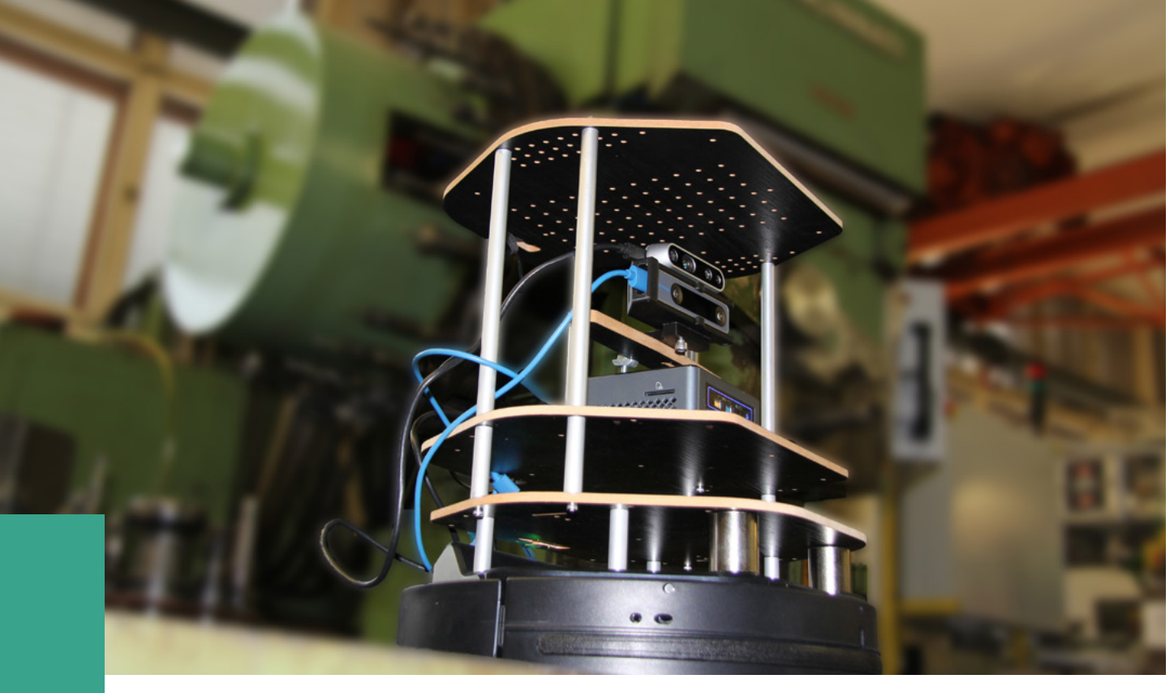
Research in the field of Laser machining processes, surface modification and non-destructive testing is geared towards:

- development of new laser machining processes for surface finishing and improvement of mechanical properties;
- optimisation of various laser processes in terms of surface integrity;
- development of a method for non-destructive testing based on monitoring of die-casting process of reinforced polymeric materials using acoustic emission signals;
- testing of glued joints by means of ultrasound.

The Joining of materials section performs the following research:

- analysis of the chemical composition of joining accelerators;
- optimisation of welding parameters and mutual weldability of dissimilar materials;
- repair-welding of tools for extending the in-service tool life, filler materials;
- development of design welding, friction stir welding and other joining technologies;
- applying different materials with high-energy arc procedures.

These topics are highly relevant for advances of manufacturing science as well as for the economic and social development of Slovenia. The research is conducted in a close cooperation with the industry.



Laboratory for Mechatronics, Production systems and Automation LAMPA

RESEARCH AREAS

Mechatronics • Robotics • Machine Vision • Automation • Control Systems • Artificial Intelligence • Blockchain • Production Systems *Material Flow • Project Management

DEPARTMENT HEAD Prof. Podržaj Primož, PhD

DEPARTMENT MEMBERS Assist. Prof. Berlec Tomaž, PhD, Assist. Prof. Bračun Drago, PhD, Assist. Corn Marko, PhD, Prof. Diaci Janez, PhD, Assist. Prof. Jenko Marjan, PhD, Juriševič Anja, Kavčič Tadeja, Kelvišar Matic, Assist. Kozamernik Nejc, Assoc. Prof. Kušar Janez, PhD, Assist. Malus Andreja, Pleterski Jan, Assist. Požrl Tomaž, PhD, Puc Jernej, Assist. Prof. Rihar Lidija, PhD, Assist. Ravnikar Dunja, PhD, Assist. Rožman Nejc, Rupert Dominik, Assist. Selak Luka, PhD, Assist. Škulj Gašper, PhD, Assist. Prof. Vrabič Rok, PhD, Assist. Žužek Tena, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

MARC, Ivan, KUŠAR, Janez, BERLEC, Tomaž. Decision-making techniques of the consumer behaviour optimisation of the product own price. Applied sciences, ISSN 2076-3417, 2022, vol. 12, iss. 4, str. 1-14.

CIMERMANČIČ, Davorin, KUŠAR, Janez, BERLEC, Tomaž. A procedure for the introduction of leanness into a company. Central European journal of operations research, ISSN 1435-246X, 2022, vol. 30, str. 1019%1049.

LUPI, Francesco, MABKHOT, Mohammed M., FINŽGAR, Miha, MINETOLA, Paolo, STADNICKA, Dorota, MAFFEI, Antonio, LITWIN, Paweł, BOFFA, Eleonora, FERREIRA, Pedro, PODRŽAJ, Primož, CHELLI, Riccardo, LOHSE, Niels, LANZETTA, Michele. Toward a sustainable educational engineer archetype through Industry 4.0. Computers in industry, ISSN 0166-3615. [Print ed.], Jan. 2022, vol. 134, str. 1-16.

HIRANISHI, Hiroaki, IMAI, Yoshiro, PODRŽAJ, Primož, OHNO, Asako, HATTORI, Tetsuo. Application of web-based visual compiler to computer education. Denki gakkai ronbunshi = : IEEJ transactions on electronics, information and systems. C, Denshi joho shisutemu bumonshi, ISSN 1348-8155, 2022, vol. 142, iss. 3, str. 389-394.

KOZJEK, Dominik, CARTER, Fred M., PORTER, Conor, MOGONYE, Jon-Erik, EHMANN, Kornel F., CAO, Jian. Data-driven prediction of next-layer melt pool temperatures in laser powder bed fusion based on co-axial high-resolution Planck thermometry measurements. Journal of manufacturing processes, ISSN 1526-6125. [Print ed.], Jul. 2022, vol. 79, str. 81-90.

RAVNIKAR, Dunja, MOJŠKERC, Bor, ŠTURM, Roman. Investigation of laser surface remelting supported by acoustic emission analysis and machine learning. Metallurgical and materials transactions. A, Physical metallurgy and materials science, ISSN 1073-5623, 2022, vol. 53, str. 837-849.

DOCTORAL DISSERTATION

ŽUŽEK, Tena. Model agilnega sočasnega razvoja izdelka za majhna in srednje velika podjetja : doktorsko delo. Ljubljana: [T. Žužek], 2022. Mentor: Janez Kušar

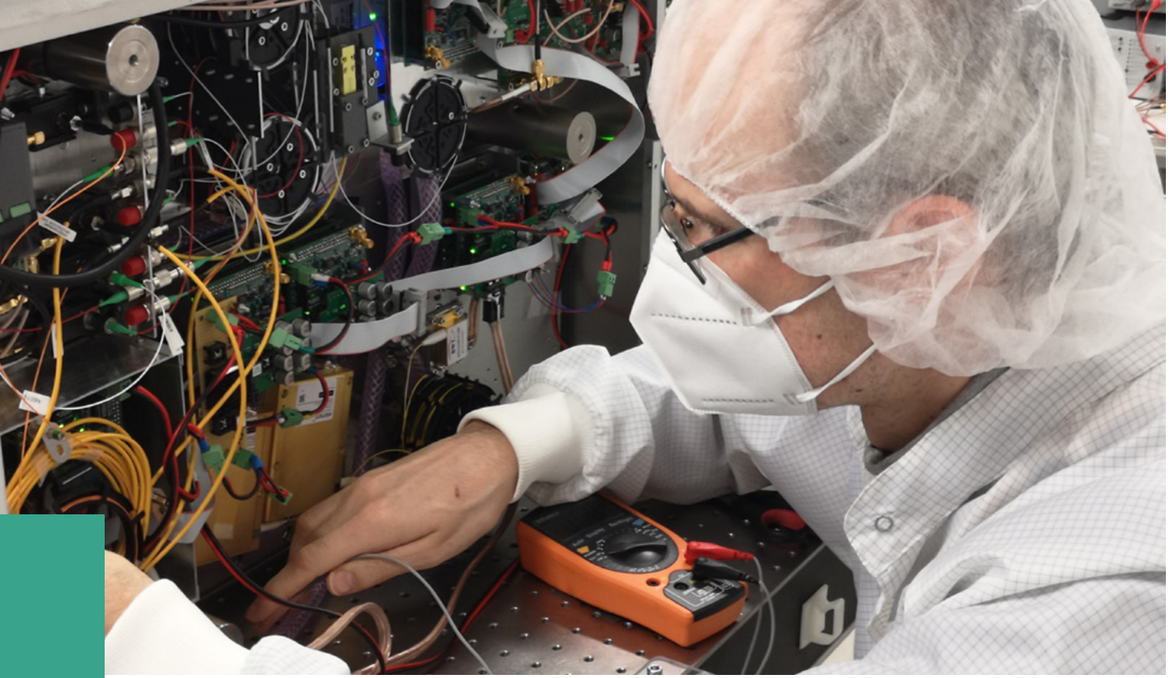
PROJECTS

ARRS - L2-3168 Development of a self-learning system for optimizing the driving rules of autonomous transport vehicles and their temporally and spatially coordinated activities 01.10.2021 - 30.09.2024.

AWARDS AND ACHIEVEMENTS

Assist. Prof. Vrabič Rok, PhD received an award of the Faculty of Mechanical Engineering for excellence in teaching.

PRODUCTION SYSTEMS, LASER TECHNOLOGIES AND MATERIALS WELDING - PLAS



Laboratory for photonics and laser systems
FOLAS

RESEARCH AREAS

Laser sources • Fiber and hybrid lasers • Photonics • Optical fiber processing • Laser transfer printing • Laser micro- and nano-processing • Laser treatment and diagnostic in medicine • High speed photography • Laser interferometric methods • Optodynamics

DEPARTMENT HEAD Prof. Rok Petkovšek, PhD

DEPARTMENT MEMBERS Assist. Prof. Vid Agrež, PhD, Assist. Darja Horvat, PhD, Assist. Žiga Lokar, PhD, Res. Assoc. Jaka Mur, PhD, Assist. Jaka Petelin, PhD, Assist. Uroš Orthaber, PhD, Assist. Luka Černe, PhD, Assist. Jernej Jan Kočica, Assist. Matevž Marš, Assist. Miha Jelenčič, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

MUR, Jaka, AGREŽ, Vid, PETELIN, Jaka, PETKOVŠEK, Rok. Microbubble dynamics and jetting near tissue-phantom biointerfaces. Biomedical optics express, ISSN 2156-7085, Feb. 2022, vol. 13, iss. 2, str. 1061-1069.

ORTHABER, Uroš, DULAR, Matevž, PETKOVŠEK, Rok. Characterization of jet parameters related to cavitation bubble dynamics in a vicinity of a flat liquid-liquid interface. Experimental thermal and fluid science, ISSN 0894-1777. [Print ed.], Aug. 2022, vol. 136, str. 1-8.

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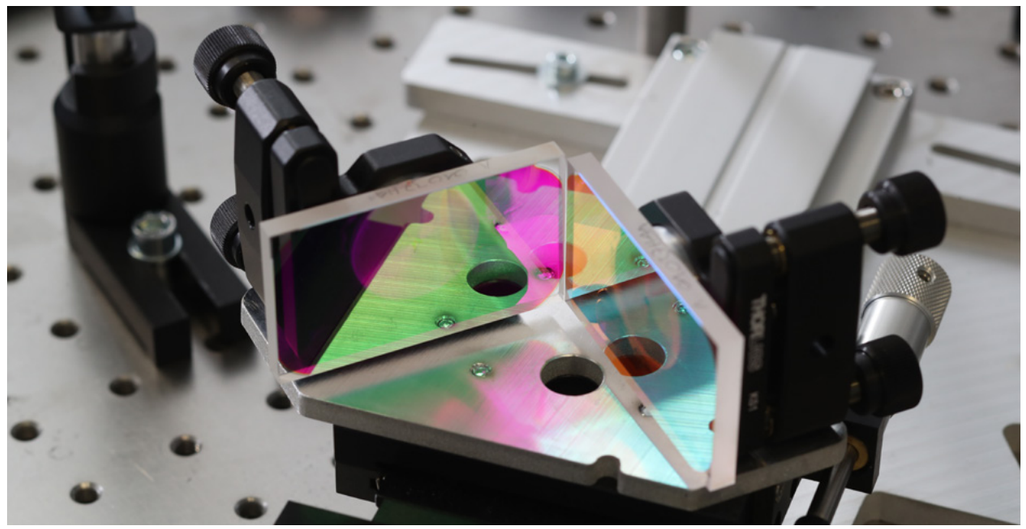

MARŠ, Matevž, PETKOVŠEK, Rok, AGREŽ, Vid. Pump control based pulse on demand operation of frequency doubled Nd:YVO [sub] 4. Optics and laser technology, ISSN 0030-3992. [Print ed.], Aug. 2022, vol. 152, str. 1-6.

MUR, Jaka, REUTER, Fabian, KOČICA, Jernej Jan, LOKAR, Žiga, PETELIN, Jaka, AGREŽ, Vid, OHL, Claus-Dieter, PETKOVŠEK, Rok. Multi-frame multi-exposure shock wave imaging and pressure measurements. Optics express, ISSN 1094-4087, 2022, vol. 30, no. 21, str. 37664-37674.

HORVAT, Darja, AGREŽ, Vid, POŽAR, Tomaž, STARMAN, Bojan, HALILOVIČ, Miroslav, PETKOVŠEK, Rok. Laser-induced shock-wave-expanded nanobubbles in spherical geometry. Ultrasonics Sonochemistry, ISSN 1350-4177, Sep. 2022, vol. 89, str. 1-12.

PATENTS

SUSIČ, Egon, SAVŠEK, Pavel, POŽAR, Tomaž, PETKOVŠEK, Rok. Cavitation sensing unit for providing a cavitation sensing signal and being adapted to be connected to a control valve of a hydrodynamic system : patentskrift DK 180883 B1, 2022-06-13. Taastrup: Danmark Patent-og Varemærkestyrelsen: = Danish Patent and Trademark Office, 2022.

PROJECTS

Horizon Europa – ENLIGHTEN- European Non-Line-of-Sight Optical Imaging. Rok Petkovšek. 01.12.2022 - 30.11.2026

Slovenian Research Agency. Generation of ultra-short laser pulses for very high speed and highly adaptable parallel microprocessing. Rok Petkovšek. 1. 10. 2021 – 30. 9. 2024

Laboratory for Heat Treatment and Materials Testing LATOP

RESEARCH AREAS

• Heat treatment • Laser surface hardening • Shot peening of surfaces • Surface integrity • Measurement of residual stresses • Determination of microstructures • Modelling of casting processes • Determination of tool life

DEPARTMENT HEAD Prof. Roman Šturm, PhD

DEPARTMENT MEMBERS Assist. Prof. Zoran Bergant, PhD, Assist. Prof. Tomaž Kek, PhD,, Assist. Prof. Sebastjan Žagar, PhD, Assist. Bor Mojškerc, PhD, Assist. Dunja Ravnikar, PhD, Vane Kralj, Anja Vrhovec, Assist. Jan Šmalc, Dušanka Grubor Železnik

ORIGINAL SCIENTIFIC ARTICLES

POTOČNIK, Primož, MISSON, Martin, ŠTURM, Roman, GOVEKAR, Edvard, KEK, Tomaž. Deep feature extraction based on ae signals for the characterization of loaded carbon fiber epoxy and glass fiber epoxy composites. Applied sciences, ISSN 2076-3417, Feb. 2022, vol. 12, iss. 4, str. 1-13.

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ZORKO, Damijan, ČERNE, Borut, BERGANT, Zoran. Zobnik iz kompozitnega materiala s kontinuirnimi vlakni : patent SI%26212 A, 2022-12-30. Ljubljana: Urad Republike Slovenije za intelektualno lastnino, 2022.

PRODUCTION SYSTEMS, LASER TECHNOLOGIES
AND MATERIALS WELDING - PLAS

Laboratory for Welding LAVAR

RESEARCH AREAS

• Technologies of material joining and assembly (arc welding, laser welding, friction stir welding, resistance welding, ultrasonic welding) • Technologies of thermal cutting • Wire arc additive manufacturing • Materials science • Production technologies • Weldability of metallic materials and polymers • Welding machines and devices • Additive and auxiliary welding materials • Chemical and metallurgical processes in welding

DEPARTMENT HEAD Assoc. Prof. Damjan Klobčar, PhD

DEPARTMENT MEMBERS Assist. Prof. Uroš Trdan, PhD, Assist. Mirza Imširović, Prof. Kosec Borut, PhD, Jaka Lavrih, Assist. Aljaž Ščetinec.

ORIGINAL SCIENTIFIC ARTICLES

KAUR, Jaspreet, SINGH, Harminder Pal, SAWHNEY, Ravinder Singh, SUI, Tan, TRDAN, Uroš. Waste biomaterial%SnO nanoparticles composite based green triboelectric nanogenerator for self-powered human motion monitoring.

ĐURIĆ, Aleksija, MILČIĆ, Dragan, BURZIĆ, Zijah, KLOBČAR, Damjan, MILČIĆ, Miodrag, MARKOVIĆ, Biljana, KRSTIĆ, Vladislav. Microstructure and fatigue properties of resistance element welded joints of DP500 steel and AW 5754 H22 aluminum alloy. Crystals, ISSN 2073-4352, Feb. 2022, vol. 12, iss. 2, str. 1-15.

MACERL, Matjaž, ZUPANIČ, Franc, HOČURŠĆAK, Lara, KLOBČAR, Damjan, KOVÁCS, Andras, BONČINA, Tonica. Microstructure and properties after friction stir processing of twin-roll cast Al%Mn%Cu%Be alloy. Crystals, ISSN 2073-4352, April 2022, vol. 12.

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KLOBČAR, Damjan, PUŠAVEC, Franci, BRAČUN, Drago, GARAŠIĆ, Ivica, KOŽUH, Zoran, VENCL, Aleksandar, TRDAN, Uroš. Influence of friction riveting parameters on the dissimilar joint formation and strength. Materials, ISSN 1996-1944, Sep. 2022, vol. 15, iss. 19, str. 1-12.

CONRADI, Marjetka, KOSEC, Tadeja, PODGORNIK, Bojan, KOCIJAN, Aleksandra, KOVAČ, Janez, KLOBČAR, Damjan. An effect of laser texturing pattern on the tribocorrosion properties of Ti6Al4V alloy in a simulated physiological solution. Surface innovations, ISSN 2050-6260, 2022, vol. 10, iss. 4/5, str. 278-288.

IMAMOVIĆ, Aida, ŠABAN, Žuna, MULAOSMANOVIĆ, Ensar, ALIBAŠIĆ, Zijad, KOSEC, Borut. Comparison of mechanical and microstructure properties of tungsten alloys for special purposes. Sustainable Engineering and Innovation, ISSN 2712-0562, 2022, vol. 4, no. 2, str. 191-197.

DOCTORAL DISSERTATION

KENDA, Miha. Izboljšave kakovosti rotacijskega mikro laserskega varjenja z dvojnim žarkom : doktorsko delo. Mentor: Damjan Klobčar

PRODUCTION SYSTEMS, LASER TECHNOLOGIES AND MATERIALS WELDING - PLAS

14 OPTODYNAMICS

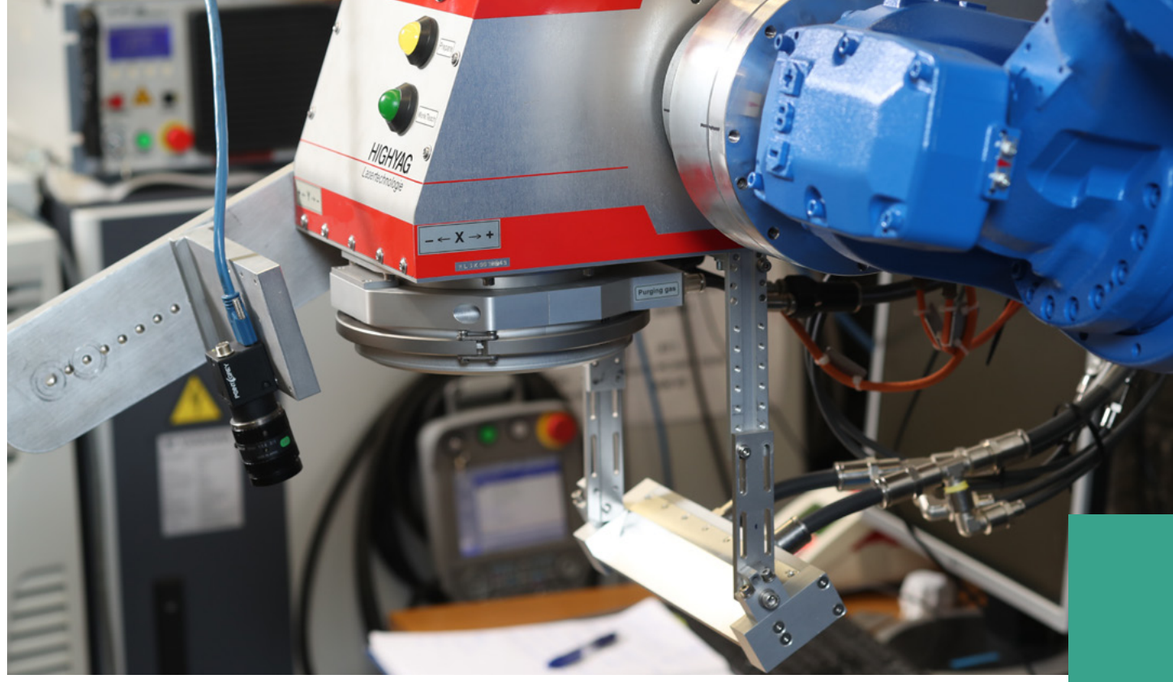
Optodynamics explores the dynamic aspects of light-to-substance interaction, which are the basis of most laser machining processes and laser-based medical interventions. Since optodynamic responses are an important source of information on the interaction between light and matter, their simultaneous detection and analysis can provide effective control over all laser processes.

The recent discovery of the programme group's researchers on characteristics of mechanical waves induced due to reflection of light is the basis for an important progress in resolving the dilemmas regarding the momentum of light in transparent media. Basic research into optodynamics leads to new applied research.

The programme also enables the development of new approaches in research on:

- laser-induced mass transfer;
- manipulation of nanoparticles;
- microfluidics;
- laser micro- and nanoprocessing;
- laser-based non-destructive testing and its transfer into practice.

The program is also oriented towards the further development and optimisation of new, more efficient and safer medical laser systems. The results of the programme are closely related to the Master's and Doctoral education programs at Faculty of Mechanical Engineering.



Laboratory for Laser Techniques LASTEH

RESEARCH AREAS

Laser measuring methods • Laser triangulation • Fiber-optic sensors • Fast photography • Interferometry • Laser machining processes • Laser micro and nano structuring • Adaptive control of laser processes • Medical laser procedures • Optodynamics

DEPARTMENT HEAD Assoc. Prof. Matija Jezeršek, PhD

DEPARTMENT MEMBERS Assoc. Prof. Peter Gregorčič, PhD, Assist. Aleš Babnik, PhD, Assist. Urban Pavlovčič, PhD, Assist. Ladislav Grad, PhD, Assist. Nejc Lukač, PhD, Assist. Luka Hribar, Assist. Daniele Vella, PhD, Assist. Matjaž Kos, Assist. Matej Senegačnik, Assist. Gaia Kravanja, Assist. Tine Brežan, Assist. Rida Ahmed, Assist. Eva Kranjc, Assits. Dominik Šavli, Emil Zubalic, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

KRAVANJA, Gaia, BELYAEVA, Inna A., HRIBAR, Luka, DREVENŠEK OLENIK, Irena, SHAMONIN, Mikhail, JEZERŠEK, Matija. Laser micromachining of magnetoactive elastomers as enabling technology for magnetoresponsive surfaces. Advanced materials technologies, ISSN 2365-709X, May 2022, vol. 7, art. no. 2101045, 8 str.

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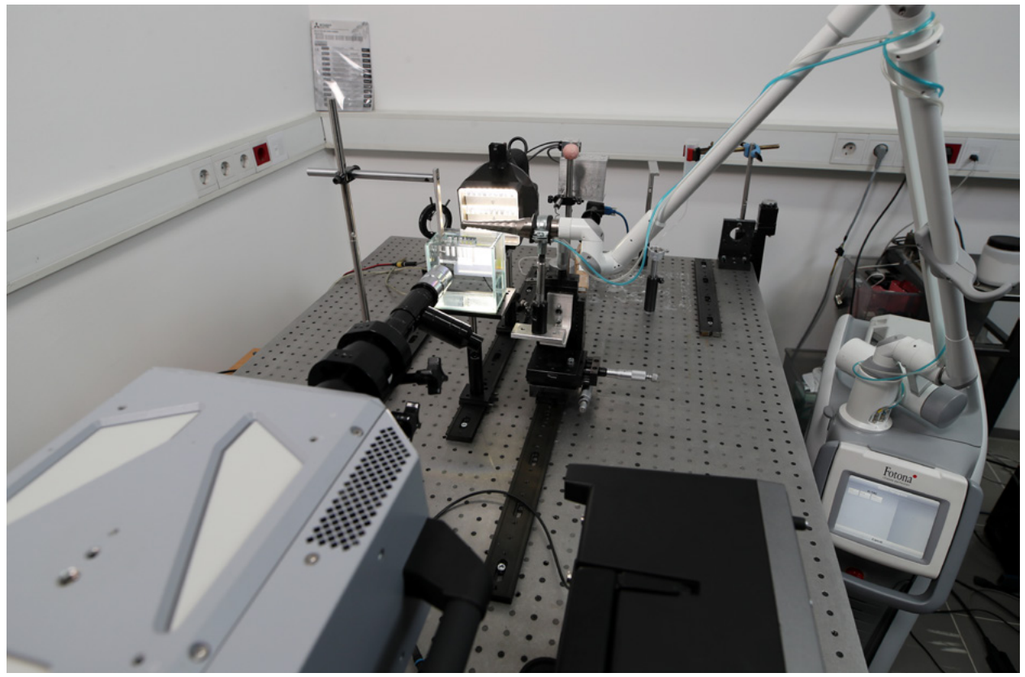

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HRIBAR, Luka, GREGORČIČ, Peter, SENEGAČNIK, Matej, JEZERŠEK, Matija. The influence of the processing parameters on the laser-ablation of stainless steel and brass during the engraving by nanosecond fiber laser. Nanomaterials, ISSN 2079-4991. [Online ed.], Jan. 2022, vol. 12, iss. 2, str. 1-20.

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KRIEGL, Raphael, KRAVANJA, Gaia, HRIBAR, Luka, ČOGA, Lucija, DREVENŠEK OLENIK, Irena, JEZERŠEK, Matija, KALIN, Mitjan, SHAMONIN, Mikhail. Microstructured magnetoactive elastomers for switchable wettability. Polymers, ISSN 2073-4360, Sep. 2022, vol. 14, art. no. 3883, 22 str.

PROJECTS

Slovenian Research Agency. Laser-induced subsurface microdestruction of tissue (LasDes). Matija Jezeršek. 1.7.2019 – 30.6.2022

Slovenian Research Agency. Laser micro and nano structuring for development of biomimetic metallic surfaces with unique properties (LaMiNaS). Peter Gregorčič. 1.7.2019 – 30.6.2022

Slovenian Research Agency. New Conventional and Additive Manufactured Biodegradable Fe-Mn alloy with Tailored Biodegradability. Peter Gregorčič. 1.7.2019 – 30.6.2022

Ministry of Education, Science and Sport - Laser Process Research for the Clinics of the Future. Matija Jezeršek. 1.05.2019 - 31.03.2022.

Slovenian Research Agency. Engineering of future innovative and smart hybrid materials by combining laser-functionalized metals and living cells (LaserInSMArT). Peter Gregorčič. 1. 10. 2021 – 30. 9. 2024

Fotona d.o.o. - Raziskave in razvoj naprednih medicinskih laserskih sistemov. Matija Jezeršek. 1.1.2022 - 31.12.2025

PATENT

KAZIČ, Marko, LUKAČ, Nejc, TAŠIČ MUC, Blaž, LUKAČ, Matjaž. Micro-pulsed liquid spray for cooling : United States Patent US 11, 490,945 B2, 2022-11-08. Alexandria: United States Patent and Trademark Office, 2022.

DOCTORAL DISSERTATION

KOŠIR, Jure. Adaptivni laserski medicinski sistem za terapijo površinskih tkiv: doktorsko delo. Ljubljana: [J. Košir], 2022. Mentor: Matija Jezeršek

OPTODYNAMIC

UNIT FOR SUPPLEMENTARY DIVISION EDZ

The Faculty of Mechanical Engineering also hosts the Unit for Supplementary Division, which is not part of research groups, but operates independently as an organisational unit. The Unit for Supplementary Division covers the areas of mathematics and sports as the key supplementary factors contributing to the teaching process.

Photo: Žan Rutar

Unit for supplementary division EDZ

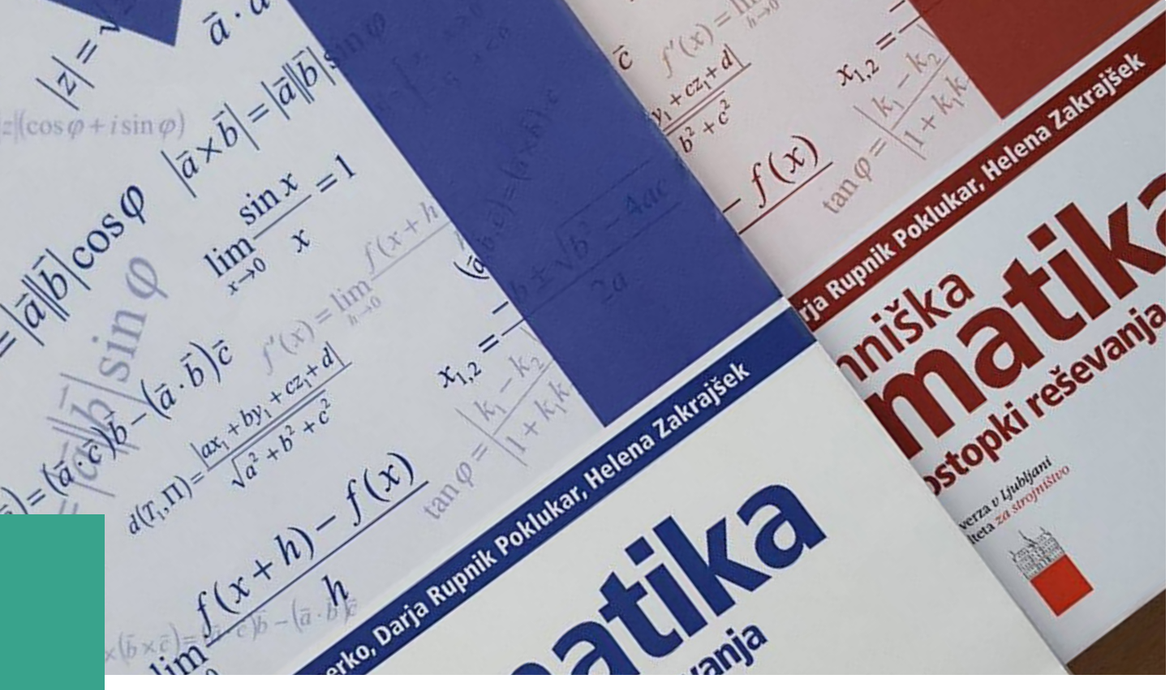
MEMBERS Žiga Bratuž, Iztok Novak

ACTIVITIES

- Organization of indoor sports activities for students (basketball, volleyball, futsal, fitness, dancing...)
- Hiking trips for students
- One day alpine skiing trips for students
- Cooper's physical fitness testing for students
- Physical education chart fitness testing for students
- Participation in various competitions of University of Ljubljana or Slovenian university sports association (basketball league, volleyball league, futsal league)

THE BEST PERFORMANCES OF FME STUDENTS IN 2022 COMPETITONS

3rd place – Volleyball team (league)
3rd place – Futsal team (tournament)
3rd place Orienteering (employees category) Robert Kunc
4th place – Basketball team (league)
Quarterfinal - Futsal team (league)



Mathematics Research Team RSMAT

DEPARTMENT HEAD Prof. Janez Žerovnik, PhD

DEPARTMENT MEMBERS Assist. Prof. Aljoša Peperko, PhD, Assist. Prof. Boštjan Gabrovšek, PhD, Assist. Tina Novak, PhD, Assist. Prof. Darja Rupnik Poklukar, PhD, Assist. Helena Zakrajšek, PhD, Assist. Brezovnik Simon, PhD, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

IKICA, Barbara, GABROVŠEK, Boštjan, POVH, Janez, ŽEROVNIK, Janez. Clustering as a dual problem to colouring. Computational & Applied Mathematics, ISSN 2238-3603, June 2022, vol. 41, iss. 4.

KHALEGHZADE, Sedighe, ZANGIABAD, Mostafa, PEPERKO, Aljoša, HAJARIAN, Masoud. Interval multi-linear systems for tensors in the max-plus algebra and their application in solving the job shop problem. Kybernetika, ISSN 0023-5954, 2022, vol. 58, no. 5, str. 708-732.

MANJEGANI, S. M., PEPERKO, Aljoša, SHOKOOH SALJOOGHI, H. Asymptotic formulae and inequalities for point spectrum in max algebra. Linear algebra and its applications, ISSN 0024-3795. [Print ed.], Feb. 2022, vol. 634, str. 112-136.

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BOGDANOVIĆ, Katarina, PEPERKO, Aljoša. Inequalities and equalities on the joint and generalized spectral and essential spectral radius of the Hadamard geometric mean of bounded sets of positive kernel operators. Linear and Multilinear Algebra, ISSN 0308-1087, [v tisku] 2022.

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RUPNIK POKLUKAR, Darja, ŽEROVNIK, Janez. Double Roman domination in generalized Petersen graphs P(ck, k). Symmetry, ISSN 2073-8994, May 2022, vol. 14, iss. 6, str. 1-15.

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PROJECTS

Slovenian Research Agency. Stochastic models for logistics of industrial processes. Janez Žerovnik. 1.9.2020 - 31.8.2023

Slovenian Research Agency. A computational library for knotted structures and applications. Boštjan Gabrovšek. 01.10.2022 - 30.09.2025

UNIVERSITY, HIGER EDUCATION OR SHORT-TERM HIGER EDUCATION TEXTBOOK WITH REVIEW

PEPERKO, Aljoša, GABROVŠEK, Boštjan. Funkcije več spremenljivk in osnove vektorske analize. 1. elektronska izd. Ljubljana: Fakulteta za strojništvo, 2022.

RUPNIK POKLUKAR, Darja, ZAKRAJŠEK, Helena. Integralske transformacije in Fourierova analiza. 1. izd. Ljubljana: Fakulteta za strojništvo, 2022.

ŽEROVNIK, Janez, GABROVŠEK, Boštjan, NOVAK, Tina, PEPERKO, Aljoša, ZAKRAJŠEK, Helena. Linearna algebra in vektorska analiza. 1. izd. Ljubljana: Fakulteta za strojništvo, 2022.

ŽEROVNIK, Janez, NOVAK, Tina, RUPNIK POKLUKAR, Darja, ZAKRAJŠEK, Helena. Navadne diferencialne enačbe in linearna algebra. 1. izd. Ljubljana: Fakulteta za strojništvo, 2022.

DOCTORAL DISSERTATION

BREZOVNIK, Simon. Resonančni grafi nekaterih dvodelnih zunajravninskih grafov in posplošena metoda prerezov : doktorska disertacija. [Maribor: S. Brezovnik], 2022. Mentor: Niko Tratnik

PROMOTION OF MECHANICAL ENGINEERING

Mechanical engineering offers many possibilities for participation and opportunities for creative solutions that are useful and interesting for people and their environment. The task of mechanical engineers is to transform ideas into products that enable them to help shape modern reality. The Faculty of Mechanical Engineering of the University of Ljubljana actively follows modern trends, promotes mechanical engineering in all its forms, organizes events, conferences and exhibitions, conducts workshops and publishes periodicals. Through its active work in the public sphere, the Faculty popularizes mechanical engineering and spreads awareness of the importance of technical sciences in everyday life.

PROMOTION OF MECHANICAL ENGINEERING IN SECONDARY SCHOOLS AND GYMNASIA

The FME pays special attention to promoting mechanical engineering in secondary schools and gymnasia, with the goal of making young people aware of the importance of this field. By joining the Inženirke in inženirji bomo! (We will be engineers!) project, young people's enthusiasm for engineering, technology and innovation is further strengthened.

MECHANICAL ENGINEERING SUMMER CAMP

Mechanical Engineering is creative and we want to show this to pupils from the 6th grade of primary school to the 3rd year of secondary school. To this end, every August we organize the Mechanical Engineering Summer Camp. In 2022, we organized it for the 9th consecutive year, which indicates that it is becoming a tradition. We had a record attendance of a whopping 91 participants, almost 10 percent of whom were girls. At the Summer School of Mechanical Engineering, participants are divided into small groups and they get to participate in thematic workshops such as hydraulic arm, 3D printing, portable weather station, remote-controlled aircraft construction, USB drink and air cooling, where participants learn about and make products to take home at the end of the workshop.

STUDENT CONFERENCE ON ENGINEERING - ŠTeKam

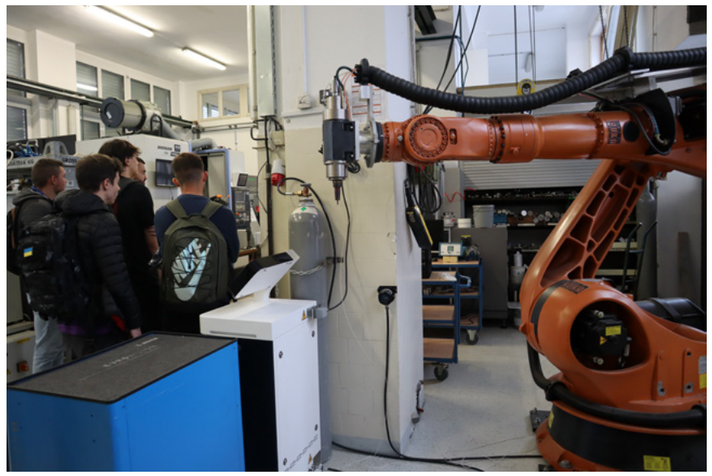
Every year in September, we enable young people to take their first step into the scientific world by presenting papers at the ŠTeKam student conference on engineering. The conference is open, which means that students from all faculties can participate, and from 2020 we have also given students from the final year of secondary schools and gymnasia the opportunity to take part. Students may also claim their participation in the conference as a remarkable achievement, a prerequisite for receiving the Zois Scholarship. All papers are published in the conference's comprehensive proceedings and entered into the Cobiss system. In 2022 18 papers arrived and 10 were presented.

MECHANICAL ENGINEERING DAYS

The Mechanical Engineering Days event is held every September in Bistra in cooperation with the Technical Museum of Slovenia and offers visitors an insight into the attractive world of engineering. During the week, the program is mainly intended for the pre-registered groups of 6th to 9th grade students and high school students, and on Sunday for individual visitors interested in the world of mechanical engineering. This time, visitors were able to take a closer look at the exceptional projects of students and established experts from the FME UL and learn many interesting things about drones, automated diagnostics, Formula Student team Ljubljana, weather forecasting, polymer materials, tribology and many other technologies.

OPEN FACULTY

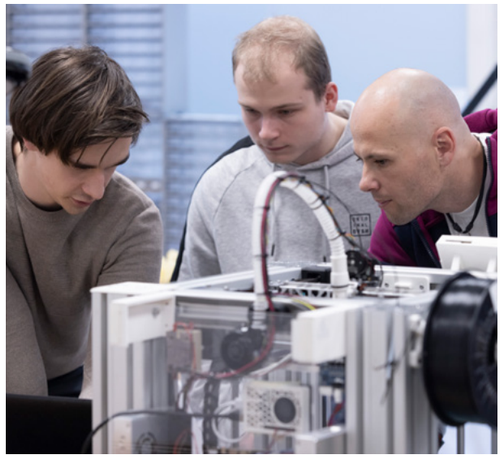
FME organized a special day Open Faculty were all the laboratories opened their doors and welcomed new students to take a look at what researchers of FME do. Students had the opportunity to ask questions, get interested in many projects and even maybe take part in them later.



OPEN LABORATORY – PESKOVNIK

One of the greatest assets for students in 2022 is certainly the Open Laboratory - Peskovnik. Peskovnik launched its activities in the summer of 2022. The mission of Peskovnik is to become the central community for student engineering engagement and innovation at the Faculty of Mechanical Engineering, University of Ljubljana. We try to build an engineering community by organising workshops, facilitating student projects, and connecting students from different disciplines.

Peskovnik's vision is encapsulated in the Membership Pledge, which commits the user to: solve any problems that arise; keep the space safe, clean and tidy; and maintain the open, friendly and educational nature of the Open Laboratory. He/she will also ensure the equality of all members.



The project is co-funded by the Republic of Slovenia, the Ministry of Education, Science and Sport and the European Union - NextGeneration EU.

UNIVERSITY OF LJUBLJANA,

FACULTY OF MECHANICAL ENGINEERING

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