UNIVERSITY OF LJUBLJANA

FS Faculty of Mechanical Engineering

Annual Report 2024

UNIVERSITY OF LJUBLJANA | FS Faculty of Mechanical Engineering

University of Ljubljana

Faculty of Mechanical Engineering

Aškerčeva cesta 6

1000 Ljubljana

Slovenia

Telephone: +386 1 4771 200

Fax: +386 1 2518 567

E-mail: dekanat@fs.uni-lj.si

Annual report 2024 | Ljubljana, 2025 | ISSN 2783-3970 | Not for sale

TABLE OF CONTENTS

UNIVERSITY OF LJUBLJANA FACULTY OF MECHANICAL ENGINEERING

FACULTY MANAGEMENT

Dean
Prof. Dr. Mihael Sekavčnik

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

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

Secretary General
Dr. Tone Češnovar

Vice Dean for Research and International Relations
Prof. Dr. Janko Slavič

SUPPORTING SERVICES

Faculty secretariat	Andreja Koban Domitrovič
Student office	Nika Vardjan Naglič
Accounts and financial department	mag. Barbara Bergant Kaučič
Human resource department	Anja Novak
Department of international cooperation, scientific and research work	mag. Tanja Mavrič Rušt
Department of Economic Affairs and Communications	Katja Pustovrh
Library	Zorka Kešelj
Technical and maintenance department	Aleš Hočevar
IT department	Grega Tomažin
Publishing department	mag. Pika Škraba
Quality Assurance Office	Alenka Rogelj Ritonja

YEAR 2024 AT THE FACULTY OF MECHANICAL ENGINEERING

In 2024, the Faculty of Mechanical Engineering (FME) reaffirmed its position as a leading academic and research institution in mechanical engineering in Slovenia. Despite the challenges posed by a rapidly evolving society, constant technological advances, and staffing issues, we have pursued our strategic objectives with vision, professionalism, and collaboration. By conducting excellent research, delivering high-quality studies, and actively transferring knowledge to the economy, we are strengthening our position as a recognised and invaluable member of the University of Ljubljana (UL) and the broader scientific community.

A significant milestone this year was the official renewal of the ASIIN and EUR-ACE accreditation until 2031, without any additional requirements. This is an important confirmation of the quality of the study programmes and systematic work for FME. At the same time as revamping the presentation of our studies and strengthening our cooperation with secondary schools, we successfully held information days and welcomed graduates to Cankarjev dom. We are proud of the more than 120 workshops we have held and the numerous individual and group projects of Peskovnik, the FME open laboratory, which remains a space for the interdisciplinary creativity of UL students.

In 2024, we have had some incredible achievements in research: ARIS will (co)fund ten (10) FME projects, ranging from basic to applied research. Our researchers have also secured several international projects. Notable projects include those in sustainable mobility, advanced energy storage, digital twins, and refrigeration technologies. We are particularly proud of our new ERC project, E-CO-HEAT, which focuses on developing an elastocaloric device.

FME researchers have had a number of high-profile publications. A total of 35 scientific papers have been published in journals with an impact factor of over 8. Among them, publications in Nature Reviews Materials, Energy & Environmental Science, and Advanced Functional Materials journals stand out.

The systematic networking of research platforms, international collaboration, and the ambition of young researchers provide a solid foundation for future development. The Faculty of Mechanical Engineering continues to fulfil its role as a strategic scientific partner to the economy, a leader in pioneering research, and a driver of technological progress in Slovenia and Europe.

The year 2024 was also a year of investment. We have completed several major projects, including the purchase of 1.37 million EUR worth of research equipment, upgrades to infrastructure and air conditioning systems, and the renovation of laboratories and classrooms.

The new building is one of the most significant infrastructural and strategic investments in the history of the Faculty. The key achievements were obtaining the building permit for the new building (16 July 2024) and completing the project documentation (Detailed Design for Construction) by the end of the year. This keeps the FME on the path of long-term spatial, research, and pedagogical renewal.

The Faculty has also grown in terms of staff numbers, with 80 new employees in 2024 and several new appointments, including three new Associate Professors. This further enhances FME's reputation and appeal as an employer.

In 2024, the Faculty of Mechanical Engineering once again proved that we know how to do it, that we want to do it, and that we can do it. We have successfully responded to the challenges of our time and paved the way for future generations of engineers through the scientific excellence, collaboration, and dedication of all members of the team. Together, we are building a sustainable, innovative, and inclusive future.

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.

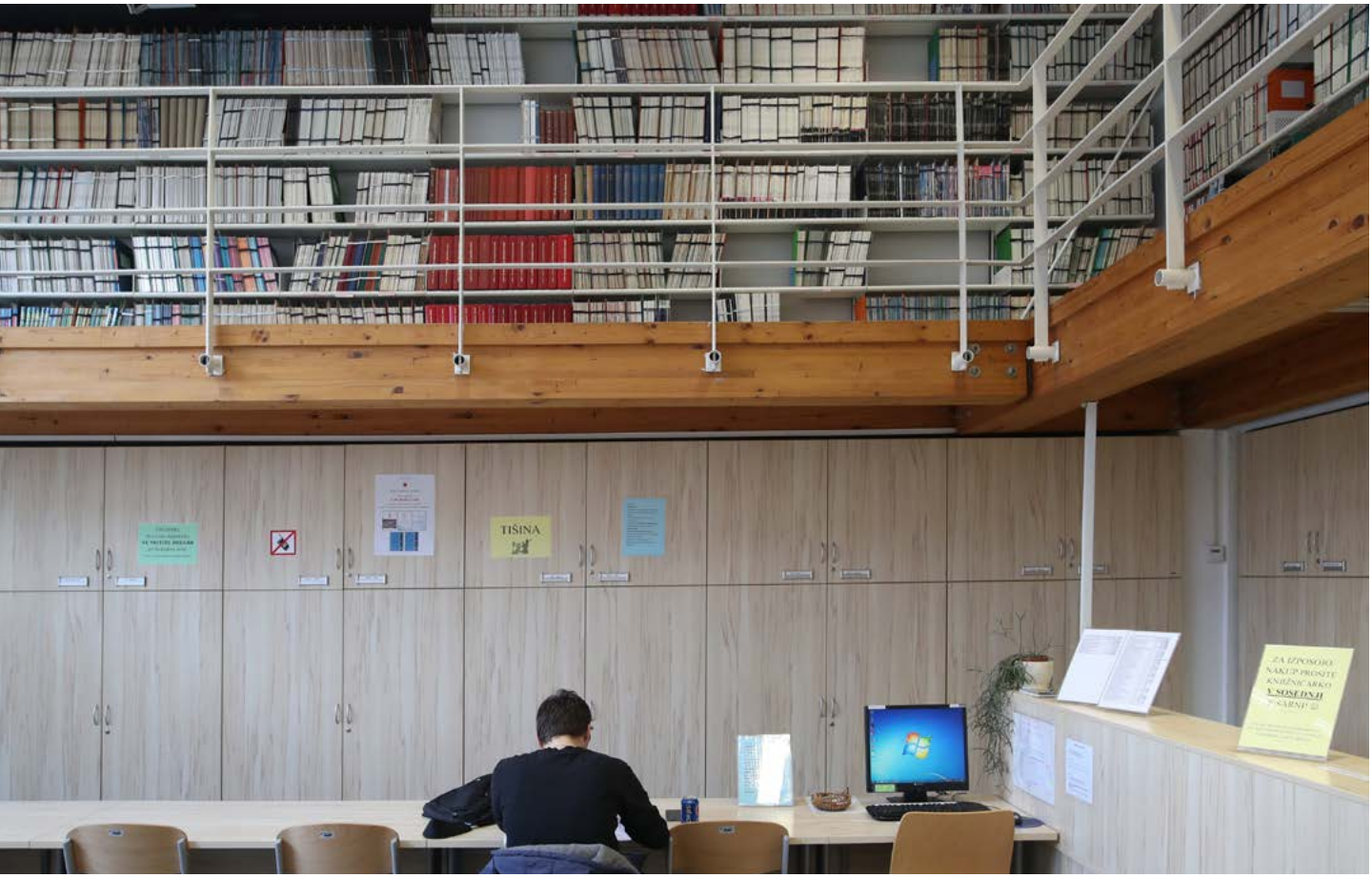


Photo: UL FME Archive

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 Dr. Milan Vidmar, 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 and Innovation Agency).

CHAIRS AND LABORATORIES AT THE FACULTY OF MECHANICAL ENGINEERING

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 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 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

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 2024, 33 laboratories and a Unit for Supplementary Division operated within the scope of 16 chairs.

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 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 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

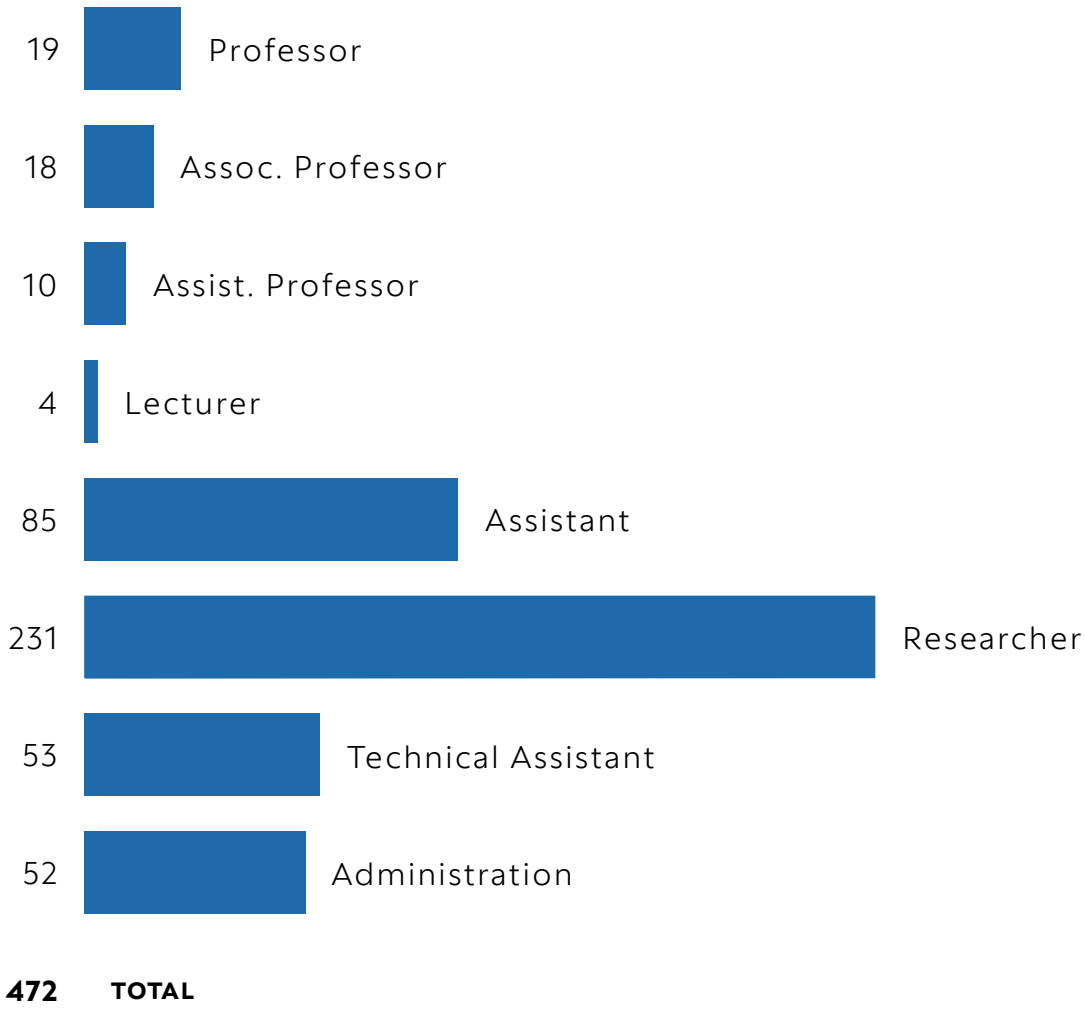
Unit for Supplementary Division EDZ

18

THE FACULTY OF MECHANICAL ENGINEERING IN NUMBERS

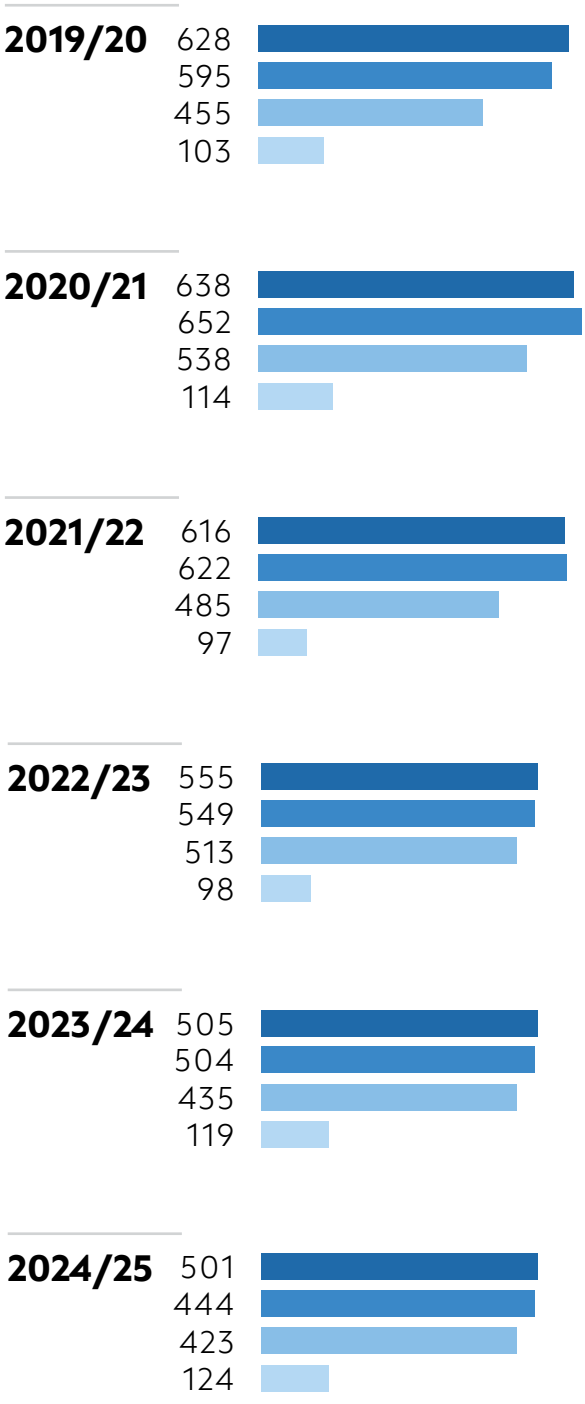
EMPLOYEE STRUCTURE

2024

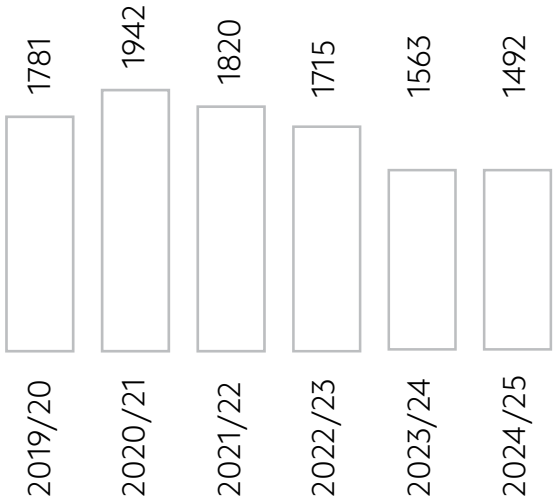


472 **TOTAL**

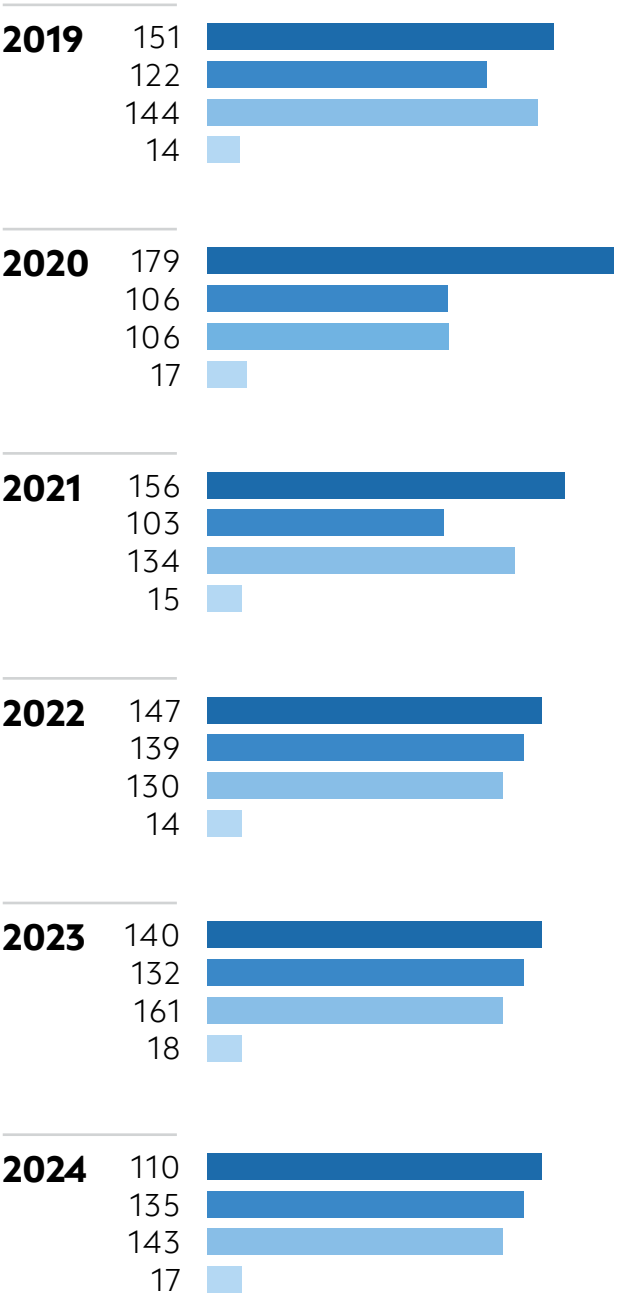
NUMBER OF ENROLLED STUDENTS



Total number of enrolled students per year



NUMBER OF GRADUATES



1st Cycle - Academic Programme

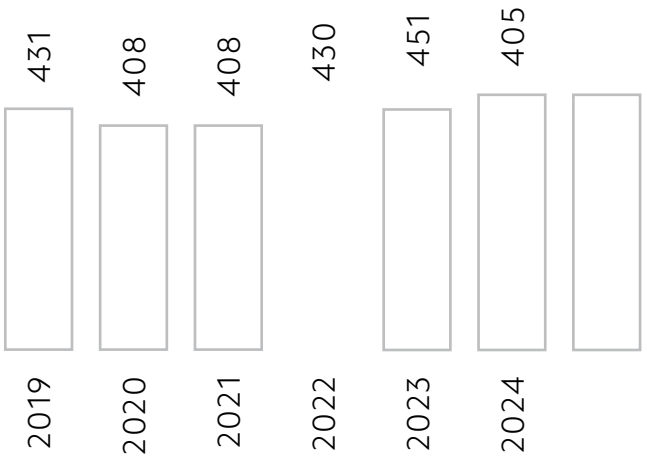
1st Cycle - Professional Programme

2nd Cycle - Master Programme

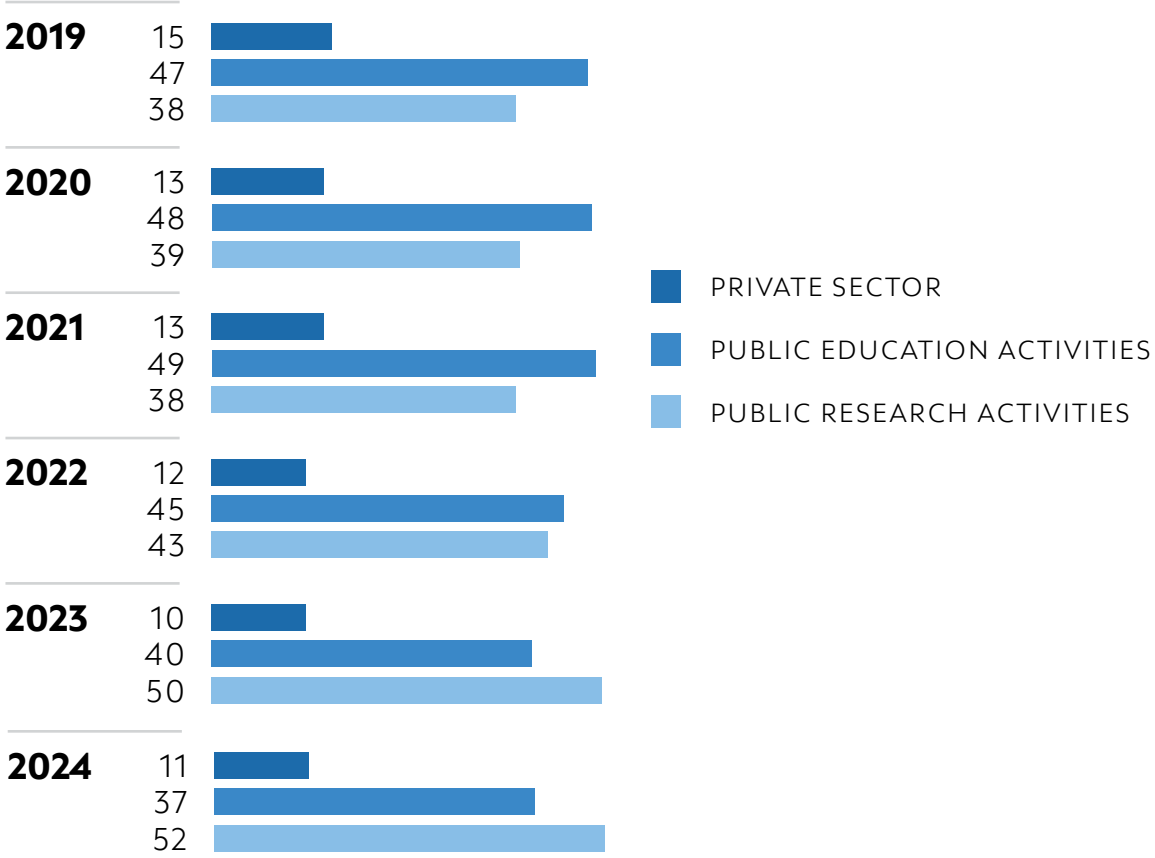
spec. + MSc (old prog.)

3rd Cycle - Doctoral Programme

Total number of graduates per year



FINANCING STRUCTURE IN %

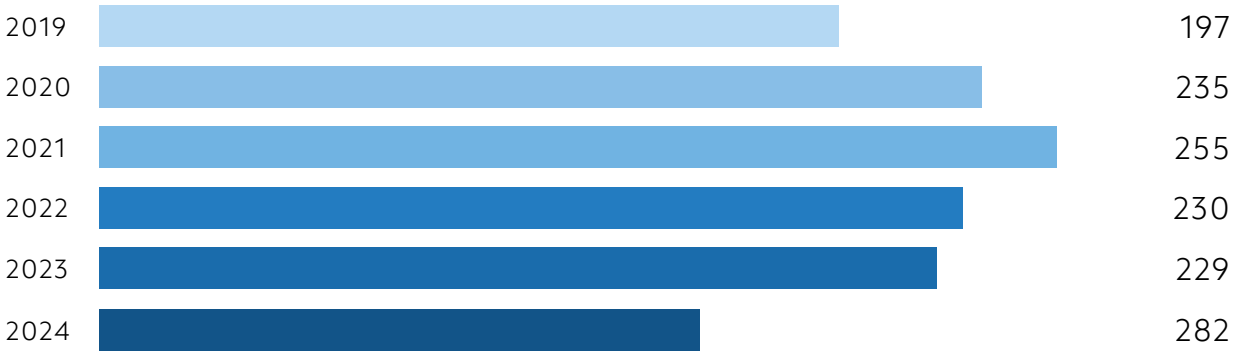


NUMBER OF INTERNATIONAL RESEARCH PROJECTS

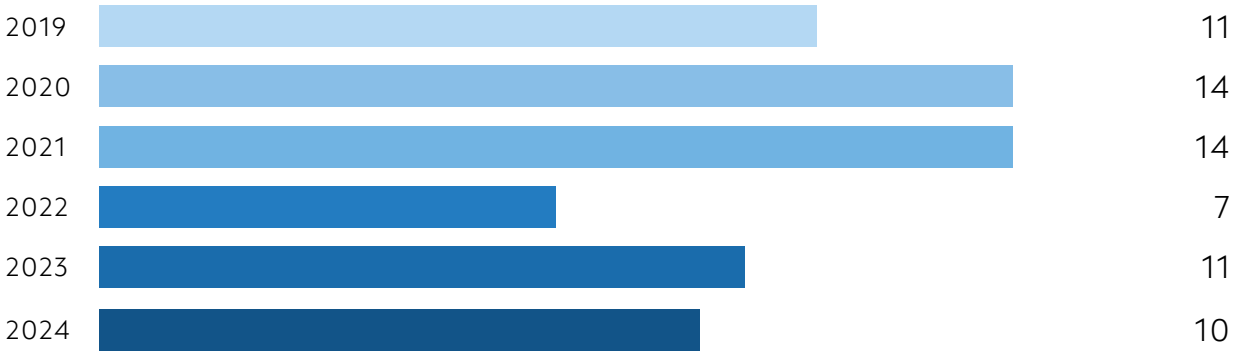
Programm	2020	2021	2022	2023	2024
Obzorje Evropa	0	0	8	26	4
Horizon 2020	12	12	13	6	5
ERDF - European regional develoment fond	4	2	0	1	1
ERA-NET M-era.Net	1	0	2	2	3
Life+	1	1	1	1	1
Erasmus +	8	9	13	15	15
European Defence Fund (EDF)	0	0	2	2	3
European defence agency (EDA)	1	1	1	3	3
European space agency (ESA)	0	0	1	4	5
Eureka	1	1	1	0	0
EIT – European Institute od Innoavation & Technology	2	3	2	3	2
COST	7	7	6	5	5
Other	7	9	16	13	13
ARRS – international projects	2	3	4	3	11
Total	**44**	**45**	**66**	**84**	**111**

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-70-2024

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 800 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 https://revija-ventil.si


Ventil / Letnik 30 / 2024 / 1 / Februar
REVIJA ZA FLUIDNO TEHNIKO, AVTOMATIZACIJO IN MEHATRONIKO
VENTIL
ISSN 1318 - 7279
Letnik 30 / 2024 / 1 / Februar
Fakulteta za strojništvo z novo raziskovalno opremo
Smernice za konstruiranje nestandardnih čepov
Izločanje zraka iz rabljenih mineralnih hidravličnih olj
Vzdrževanje hidravličnih naprav
industrijska
olja in maziva
OLMA
WWW.OLMA.SI
OLMA 77
SINCE 1947
Univerza v Ljubljani
Fakulteta za strojništvo
FESTO
POCLAIN Hydraulics
Parker
laxco
OMEGA AIR more than air
PODKRIŽNIK
SEAL & TRADE d.o.o.
ppt commerce
OPL
hpe

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.

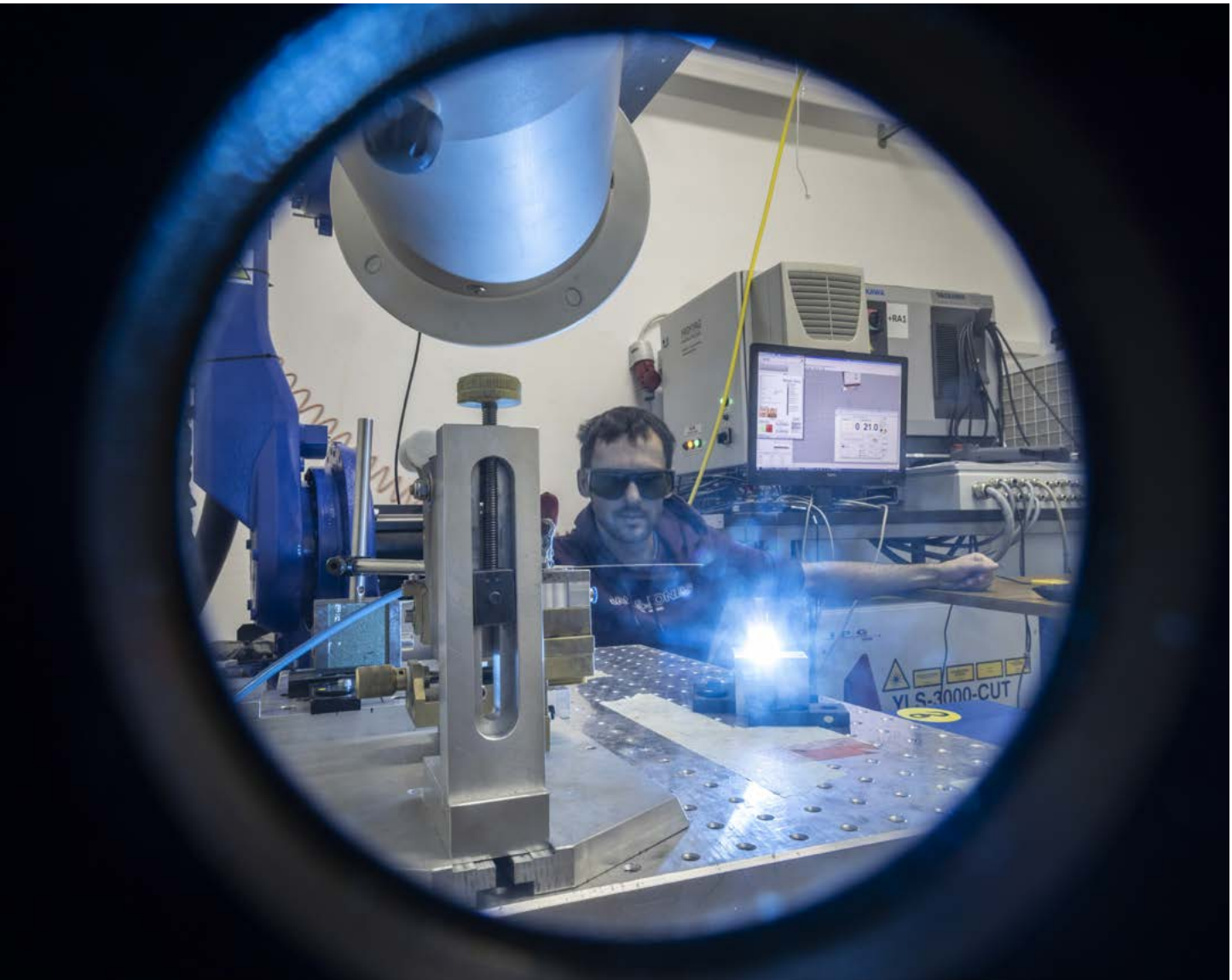
Program groups

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. Fuctionaliesed fluids for advanced enery systems
10. Mechanics in Engineering
11. Sustainable Polymer Materials and Technologies
12. Advanced production technologies for high quality and sistainable production
13. Production systems, laser technologies and materials welding - PLAS
14. Optodynamics
15. Fusion technologies
16. Decentralized solutions fort he digitalization of industry and smart cities and communities

PRESENTATION OF PROGRAMME GROUPS AND ACTIVITIES OF LABORATORIES

Photo: Željko Stevanić, IFP d.o.o.



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. dr. Robert Kunc

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

ORIGINAL SCIENTIFIC ARTICLES

NEBOT-ANDRÉS, Laura, PETRUZZIELLO, Fabio, APREA, Ciro, LLOPIS, Rodrigo, ŽEROVNIK, Andrej, MAIORINO, Angelo, TUŠEK, Jaka. Parametric analysis of hybrid elastocaloric – CO2 cooling system. Applied thermal engineering. Sept. 2024, vol. 253, [article no.] 123843, str. 1-10, ilustr. ISSN 1359-4311.

TRAJKOVSKI, Jovan, KUNC, Robert. Strain rate sensitivity of low carbon threaded steel rods of grade 4.6 : by Jovan Trajkovski and Robert Kunc. Materials. 2024, vol. 17, iss. 24, [art. no.] 6228, str. 1-14, ilustr. ISSN 1996-1944

Photo: Željko Stevanić, IFP d.o.o.

KOPYLOV, Semen, AMBROŽ, Miha, PETAN, Žiga, KUNC, Robert, ZHENG, Sifa, HOU, Zhichao. Vehicle pitch dynamics control using in-wheel motors. Proceedings of the Institution of Mechanical Engineers. Part D, Journal of automobile engineering. 2024, str. 1-12, ilustr. ISSN 0954-4070.

TRAJKOVSKI, Jovan, AMBROŽ, Miha, KUNC, Robert. Gravel arrester beds as a safety measure at the motorway exit ramps : experimental and numerical study. Road materials and pavement design. 2024, vol. 25, no. 1, str. 99-114, ilustr. ISSN 2164-7402.

ZUPAN, Samo, KUNC, Robert. Overview of principles and rules of geometrical product specifications according to the current ISO standards. Strojniški vestnik. Jan.-Feb. 2024, vol. 70, no. 1/2, str. 3-19, ilustr. ISSN 0039-2480.

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

KUNC, Robert (avtor, ilustrator), KRAŠNA, Simon (avtor, ilustrator). Analiza in sinteza mehanizmov : postopki reševanja izbranih primerov. 1. elektronska izd. Ljubljana: Fakulteta za strojništvo, 2024.

PROJECTS

SMM d.o.o. Research work. Robert Kunc. Ongoing since 1.1.2016

Slovenian Research and Innovation Agency. Road traffic safety - Development of new road traffic safety assessment methodology. Robert Kunc. 1.10.2022 - 30.9.2024

European Defence Agency. HybriDT II. Hybrid drive train demonstrator – Phase 2. Miha Ambrož. 6. 9. 2023 – 5. 12. 2024

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.

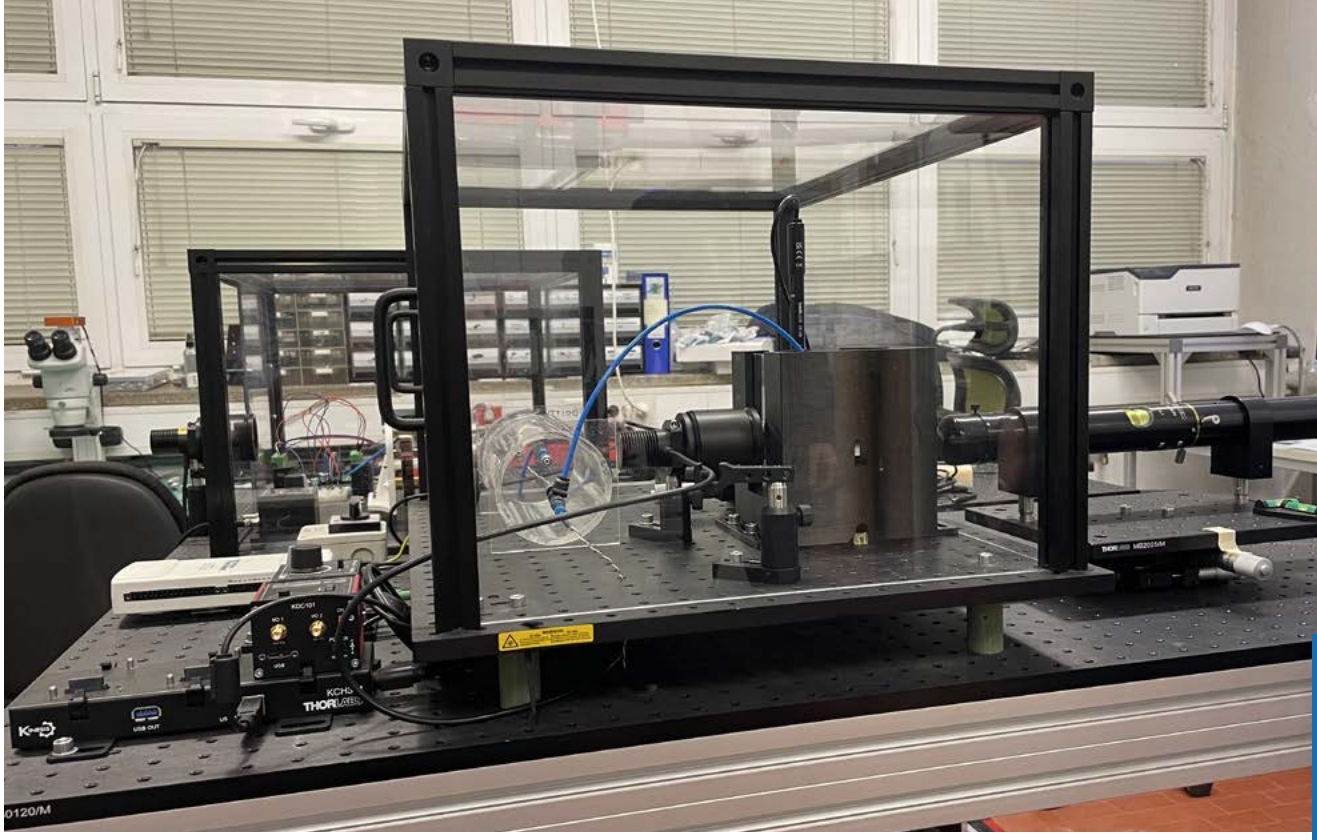


Photo: Željko Stevanić, IFP d.o.o

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. dr. Božidar Šarler

DEPARTMENT MEMBERS Assist. Prof. dr. Anton Bergant, Assist. Prof. dr. Andrej Bombač, Assist. Prof. dr. Matjaž Perpar, Assist. Prof. dr. Boštjan Mavrič, Assist. dr. Zahoor Rizwan, Res. Assoc. dr. Zlatko Rek, Assist. dr. Umut Hanoglu, Res. Assoc. dr. Katarina Mramor, Res. Assoc. dr. Miha Kovačič, Res. Assoc. dr. Robert Vertnik, Res. Assoc. dr. Qingguo Liu, Matic Cotič, Assist. Rana Khush Bakhat, Assist. Gašper Vuga, Assist. Ajda Kunavar, Assist. dr. Tadej Dobravec, Assist. Izaz Ali, Assist. Kovačič Krištof, Assit. Bor Zupan, Zdenka Rupič

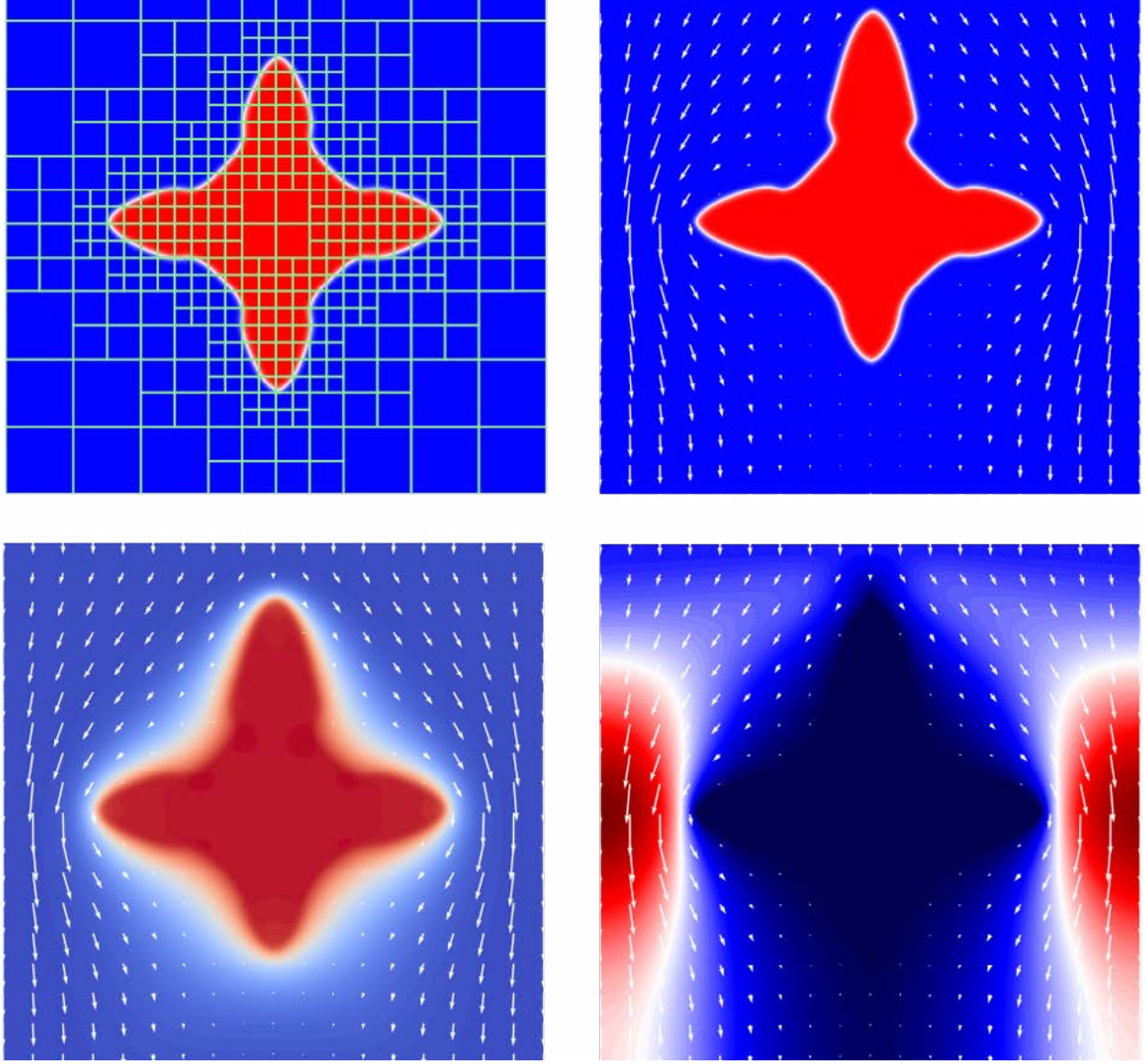
ORIGINAL SCIENTIFIC ARTICLES

KOVAČIČ, Miha, ZUPANC, Anže, ŽUPERL, Uroš, BREZOČNIK, Miran. Reducing scrap in long rolled round steel bars using Genetic Programming after ultrasonic testing. Advances in production engineering & management. Dec. 2024, vol. 19, no. 4, str. 435-442, ilustr. ISSN 1855-6531.

VUGA, Gašper, MAVRIČ, Boštjan, ŠARLER, Božidar. An improved local radial basis function method for solving small-strain elasto-plasticity. Computer methods in applied mechanics and engineering. [Print ed.]. Jan. 2024, vol. 418, pt. a, str. 1-28, ilustr. ISSN 0045-7825

REK, Zlatko, ŠARLER, Božidar. Formulation of the method of fundamental solutions for two-phase Stokes flow. Engineering analysis with boundary elements. Jan. 2024, vol. 158, str. 199-210, ilustr. ISSN 0955-7997.

VUGA, Gašper, MAVRIČ, Boštjan, ŠARLER, Božidar. A hybrid radial basis function-finite difference method for modelling two-dimensional thermo-elasto-plasticity, Part 1 : method formulation and testing. Engineering analysis with boundary elements. Feb. 2024, vol. 159, str. 58-67, ilustr. ISSN 0955-7997.



Phase field without fluid circulation (top-left), phase field with circulation (top-right), temperature field (bottom-left) and absolute velocity value (bottom-right).

VUGA, Gašper, MAVRIČ, Boštjan, HANOGLU, Umut, ŠARLER, Božidar. A hybrid radial basis function-finite difference method for modelling two-dimensional thermo-elasto-plasticity. Part 2, Application to cooling of hot-rolled steel bars on a cooling bed. Engineering analysis with boundary elements. Feb. 2024, vol. 159, str. 331-341, ilustr. ISSN 0955-7997.

VUGA, Gašper, MAVRIČ, Boštjan, ŠARLER, Božidar. Strong-form meshless numerical modelling of visco-plastic material. Engineering analysis with boundary elements. Oct. 2024, vol. 167, [art. no.] 105868, str. 1-17, ilustr. ISSN 0955-7997.

RANA, Khush Bakhat, MAVRIČ, Boštjan, ZAHOOR, Rizwan, ŠARLER, Božidar. Phase-field formulated meshless simulation of axisymmetric Rayleigh-Taylor instability problem. Engineering analysis with boundary elements. Dec. 2024, vol. 169, part a, art. 105953, str. 1-14, ilustr. ISSN 0955-7997.

ALI, Izaz, VUGA, Gašper, MAVRIČ, Boštjan, HANOGLU, Umut, ŠARLER, Božidar. Fourth-order phase field modelling of brittle fracture with strong form meshless method. Engineering analysis with boundary elements. Dec. 2024, vol. 169, pt b, [art.] 106025, str. 1-14, ilustr. ISSN 0955-7997.

KOVAČIČ, Krištof, BAJT, Saša, ŠARLER, Božidar. Numerical analysis of knudsen number of helium flow through gas-focused liquid sheet micro-nozzle. Fluids. 2024, vol. 9, iss. 12, [art. no.] 273, str. 1-15, ilustr. ISSN 2311-5521.

ZAHOOR, Rizwan, BAJT, Saša, ŠARLER, Božidar. A numerical study of gas focused non-Newtonian micro-jets. International journal of multiphase flow. Jan. 2024, vol. 170, str. 1-16, ilustr. ISSN 0301-9322.

KOVAČIČ, Krištof, GREGORC, Jurij, ŠARLER, Božidar. Numerical modelling and experimental validation of dripping, jetting and whipping modes of gas dynamic virtual nozzle. International journal of numerical methods for heat & fluid flow. Mar. 2024, vol. 34, iss. 4, str. 1582-1608, ilustr. ISSN 0961-5539.

ZAHOOR, Rizwan, BAJT, Saša, ŠARLER, Božidar. A numerical study of double flow focusing micro-jets. International journal of numerical methods for heat & fluid flow. 2024, vol. , iss. , str. [1-21], ilustr. ISSN 0961-5539.

BERGANT, Anton, MAZIJ, Jernej, PEKOL], Jošt. Theoretical and experimental investigations of a water hammer in Sava river Kaplan turbine hydropower plants = Teoretične in eksperimentalne raziskave vodnega udara v hidroelektrnah s Kaplanovimi turbinami na reki Savi. Journal of energy technology. [Tiskana izd.]. dec. 2024, vol. 17, iss. 4, str. 11-20, ilustr. ISSN 1855-5748

ŽUPERL, Uroš, KOVAČIČ, Miha. Modeling of the cutting forces in end milling of a metallic multilayer material = Modeliranje rezalnih sil pri čelnem rezkanju kovinskega večplastnega materiala. Materiali in tehnologije. [Tiskana izd.]. 2024, let. 58, št. 4, str. 443-449, ilustr. ISSN 1580-2949

ALI, Izaz, HANOGLU, Umut, VERTNIK, Robert, ŠARLER, Božidar. Assessment of local radial basis function collocation method for diffusion problems structured with multiquadrics and polyharmonic splines. Mathematical and computational applications. [Online ed.]. Mar. 2024, vol. 29, iss. 2, [article no.] 23, str. 1-31, ilustr. ISSN 2297-8747.

LIU, Qingguo, HANOGLU, Umut, REK, Zlatko, ŠARLER, Božidar. Simulation of temperature field in steel billets during reheating in pusher-type furnace by meshless method. Mathematical and computational applications. [Online ed.]. Apr. 2024, vol. 29, iss. 3, [article no.] 30, str. 1-16, ilustr. ISSN 2297-8747.

KOVAČIČ, Miha, ZUPANC, Aljaž, VERTNIK, Robert, ŽUPERL, Uroš. Optimization of billet cooling after continuous casting using genetic programming—industrial study. Metals. July 2024, vol. 14, iss. 7, [article no.] 819, 12 str., ilustr. ISSN 2075-4701.

MUNĐAR, Goran, KOVAČIČ, Miha, BREZOČNIK, Miran, STĘPIEŃ, Krzysztof, ŽUPERL, Uroš. Rapid assessment of steel machinability through spark analysis and data-mining techniques. Metals. Aug. 2024, vol. 14, iss. 8, [article no.] 955, 19 str., ilustr. ISSN 2075-4701.

ZAKHAROVA, Margarita, REK, Zlatko, ŠARLER, Božidar, BAJT, Saša. On the thermal stability of multilayer optics for use with high X-ray intensities. Optical materials express. [Online ed.]. 2024, vol. 14, iss. 8, str. 1933-1948, ilustr. ISSN 2159-3930.

BABIČ, Matej, KOVAČIČ, Miha, FRAGASSA, Cristiano, ŠTURM, Roman. Selective laser melting : a novel method for surface roughness analysis. Strojniški vestnik. July-Aug. 2024, vol. 70, no. 7/8, str. 313-324, ilustr. ISSN 0039-2480.

MUNĐAR, Goran, KOVAČIČ, Miha, ŽUPERL, Uroš. Development and control of virtual industrial process using Factory IO and MATLAB. Tehnički glasnik. 2024, vol. 18, no. 3, [article no.] 319192, str. 497-501, ilustr. ISSN 1848-5588.

PROJECTS

Slovenian Research and Innovation Agency. Development of innovative meshless methods for multiphysics and multiscale simulation of cutting-edge technologies. Božidar Šarler. 1.10.2022 - 30.9.2025

Slovenian Research and Innovation Agency. Advanced meshless modelling and simulation of microstructure evolution for the top-quality metal products. Tadej Dobravec. 1.10.2022 - 30.9.2024

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

Slovenian Research and Innovation Agency. Advanced simulation and optimization of the entire process route for production of topmost steels. Božidar Šarler. 1.10.2021 - 30.9.2024

Štore Steel. Enhancements of the steel processing simulation system. Božidar Šarler. 1.5.2024 – 31.12.2025

AWARDS AND ACHIEVEMENTS

Assist. Dr. Gašper Vuga received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements.

03 ENERGY ENGINEERING

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

1. 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.

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

3. 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.

4. 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.

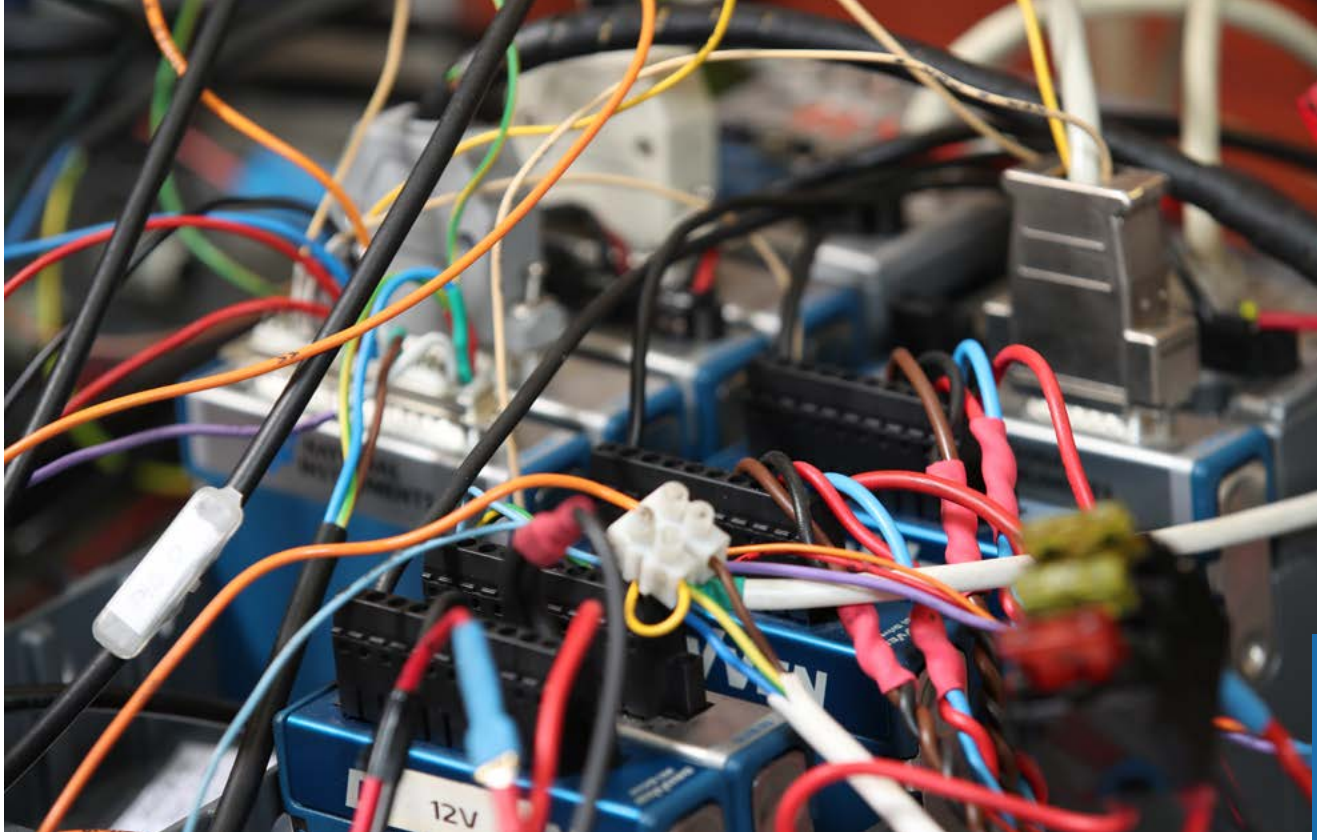


Photo: Željko Stevanić, IFP d.o.o.

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. dr. Tomaž Katrašnik

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

ORIGINAL SCIENTIFIC ARTICLES

ŽNIDARČIČ, Anton, TUROLLA, Andrea, BONIARDI, Gaia, CANZIANI, Roberto, SEL]AK, Tine. The impact of struvite presence on the thermal decomposition of sewage sludge, including formation of NO$_x$ emissions. Applied thermal engineering. 2024, vol. 255, [art.] 123976, str. 1-13, ilustr. ISSN 1359-4311.

TIBAUT, Tilen, ZELIČ, Klemen, KATRAŠNIK, Tomaž. Transmission line model of intercalation electrode particle in lithium-ion batteries. Journal of the electrochemical society. [Online ed.]. Feb. 2024, vol. 171, no. 2, [article no.] 020515, str. 1-10, ilustr. ISSN 1945-7111.

MELE, Igor, ZELIČ, Klemen, FIRM, Marko, MOŠKON, Jože, GABERŠČEK, Miran, KATRAŠNIK, Tomaž. Enhanced porous electrode theory based electrochemical model for higher fidelity modelling and deciphering of the EIS spectra. Journal of the electrochemical society. [Online ed.]. 2024, vol. 171, no. 8, art. 080537, str. 1-17, ilustr. ISSN 1945-7111

PROJECTS

Horizon 2020. MORELife. Material, Operating strategy and REliability optimisation for LIFEtime improvements in heavy duty trucks. Tomaž Katrašnik. 1.9.2021 - 31.8.2024

Photo: Željko Stevanić, IFP d.o.o

Slovenian Research and Innovation 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. 1.9.2021 - 31.8.2024

Slovenian Research and Innovation Agency. Multiscale modelling of degradation phenomena in membrane electrode assemblies of proton exchange membrane fuel cells produced of advanced materials. Tomaž Katrašnik. 1.2.2022 - 31.1.2024

Horizon Europe. INDY. Energy Independent and Efficient Deployable Military Camps. Tomaž Katrašnik. 1.12.2022 – 31.1.2025

Horizon Europe. PULSELION. Pulsed Laser igitaliza tEchnology for soLid State battery igitalizatio supported by igitalization. Tomaž Katrašnik. 1.9.2022 - 31.8.2026

Horizon Europe. ADVAGEN. Development of ADVAnced next GENeration Solid-State batteries for Electromobility Applications. Tomaž Katrašnik. 1.8.2022 - 31.7.2026

Austrian Research Promotion Agency (FFG). MoSiLiB. Modeling and development of silicon- tin sulfide composite anodes for generation 3b lithium-ion batteries. Tomaž Katrašnik. 1.6.2022 - 31.5.2025

Horizon Europe. NEXTCELL. Towards the next generation of high performance li-ion battery cells. Tomaž Katrašnik. 1.1.2023 – 31.12.2026

Horizon Europe. BLESSED. Bridging Models at Different Scales To Design New Generation Fuel Cells for Electrified Mobility. Tomaž Katrašnik. 1.2.2023 – 31.1.2027

Horizon Europe. FASTEST. Fast-track hybrid testing platform for the development of battery systems. Tomaž Katrašnik. 1.6.2023 – 31.5.2026

Horizon Europe. HiHELIOS. demonstrating a High-energy and High-power hybrid battery storagE soLutIonS platform for multiple grid services. Tomaž Katrašnik. 1.12.2024 - 31.5.2028

Slovenian Research and Innovation Agency. HyBReED. Development of resilient chemical energy storage with hydrogen and batteries. Tomaž Katrašnik. 1.1.2024 – 30.6.2026

Horizon Europe. InnoBMS. Situationally aware innovative battery management system for next generation vehicles. Tomaž Katrašnik. 1.1.2024 - 30.6.2027

Horizon Europe. SENERGY NETS. Increase the Synergy among different ENERGY NETworkS. Tine Seljak. 1.9.2022 - 30.8.2026Horizon Europe. NEXTBMS. NEXT-generation physics and data-based Battery Management Systems for optimised battery utilization. Tomaž Katrašnik. 1.6.2023 – 30.11.2026

Horizon Europe. MEAsureD. Advanced MEAs ensuring high efficiency HDV. Tomaž Katrašnik. 1.6.2023 – 31.5.2026

Horizon Europe. NAHV. North Adriatic Hygrogen Valley. Tomaž Katrašnik. 1.9.2023 – 31.8.2029

Horizon Europe. RealHyFC. Reliable durable high power hydrogen fueled PEM Fuel Cell stack. Tomaž Katrašnik. 1.6.2023 – 31.5.2026

European Defence Agency. HybriDT II. Hybrid drive train demonstrator – Phase 2. Tomaž Katrašnik. 6.9.2023 – 5.12.2024

AWARDS AND ACHIEVEMENTS

Prof. Dr. Tomaž Katrašnik received the Zois Prize for outstanding achievements.

Prof. Dr. Tomaž Katrašnik, together with his colleagues Assoc. Prof. Dr. Klemen Zelič and Igor Mele, and researchers from the National Institute of Chemistry received the "Excellent in Science" award for an interdisciplinary study published in the prestigious scientific journal Advanced Materials: "Entering voltage hysteresis in phase-separated materials: discovering the electrochemical response of the intraparticle phase-separated state".

Assist. Prof. Dr. Klemen Zelič received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements

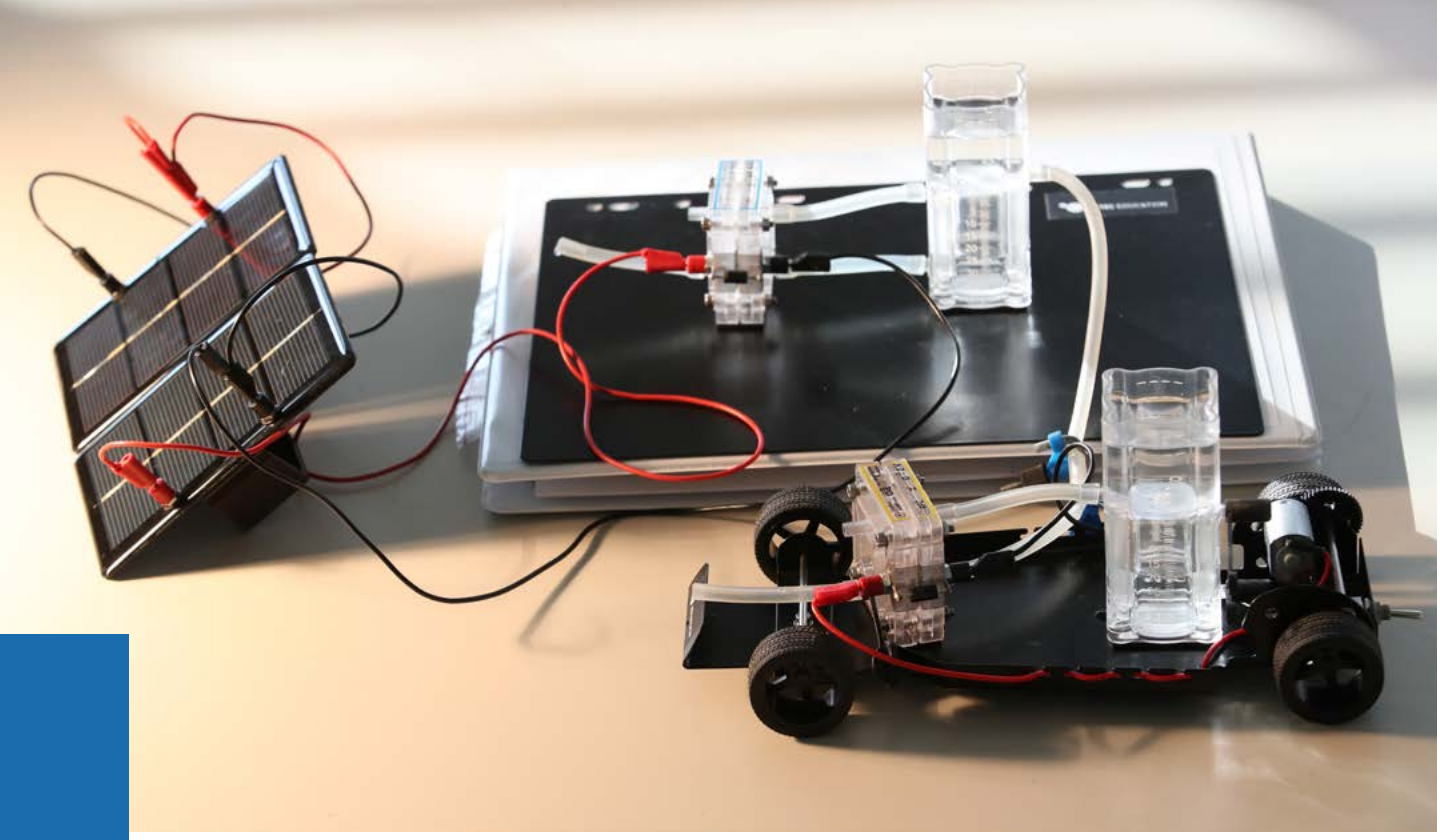


Photo: Željko Stevanić, IFP d.o.o

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. dr. Mihael Sekavčnik

DEPARTMENT MEMBERS Assoc. Prof. dr. Andrej Senegačnik, Assist. Prof. dr. Boštjan Drobnič, Assist. Prof. dr. Mitja Mori, Res. Assoc. dr. Igor Kuštrin, Assist. dr. Andrej Lotrič, Assist. dr. Rok Stropnik, Assist. Jure Gramc, Assist. Emilija Todorovski, Assist. Filip Todorovski, Assist. Mihael Boštjan Končar, Assist. Domen Hojkar, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

SENEGAČNIK, Andrej, SEKAVČNIK, Mihael. The illusion of a green transition in Slovenia by 2050. Strojniški vestnik. Sept.-Oct. 2024, vol. 70, no. 9/10, str. 405-416, ilustr. ISSN 0039-2480.

PROJECTS

Slovenian Research and Innovation Agency. PROMETHEIA - Processes for metal-to-char encapsulation. Mihael Sekavčnik. 1.12.2021 - 30.11.2025

Horizon Europe. SENERGY NETS. Increase the Synergy among different ENERGY NETworkS. Mitja Mori. 1.9.2022 - 30.08.2026

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

Termoelektrarna Brestanica. Izvedba termičnih prevzemnih preizkusov plinske turbine PB7 v Termoelektrarni Brestanica. Mihael Sekavčnik. 6.5.2024 - 5.5.2025

Horizon Europe. HYScale. Economic green hydrogen production at scale via a novel, critical raw material free, highly efficient and low-capex advanced alkaline membrane water electrolysis technology. Mitja Mori. 1.6.2023 - 31.5.2027

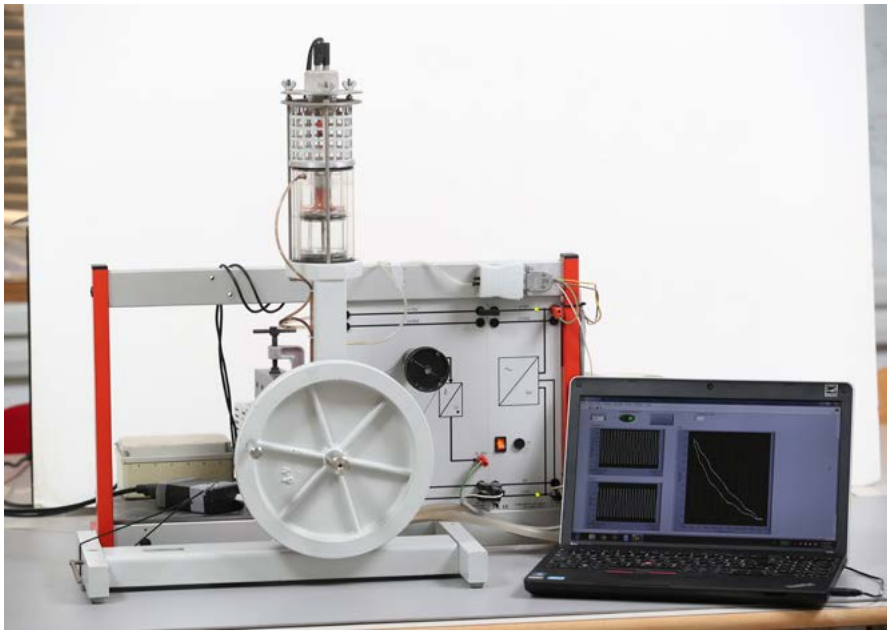


Photo: Željko Stevanić, IFP d.o.o

Horizon Europe. HYGHER. HYdroGen High pressure supply chain for innovative and cost Efficient distribution. Mitja Mori. 1.1.2024 - 31.12.2026

Horizon Europe. SINGLE. Electrified Single Stage Ammonia Cracking to Compressed Hydrogen. Mitja Mori. 1.5.2023 - 30.4.2026

Horizon Europe. SURE2COAT. Sustainable surface treatments of complex shape components for transsectorial industrial innovation. Mitja Mori. 1.1.2023 – 31.12.2025

Horizon Europe. PilotSOEL. Advanced Processes Enabling Low cost and High Performing Large Scale Solid Oxide Electrolyser Production. Rok Stropnik. 1.6.2023 - 31.5.2026

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Mitja Mori. 1.1.2024 – 30.6.2026

Slovenian Research and Innovation Agency. HyBReED. Development of resilient chemical energy storage with hydrogen and batteries. Mihael Sekavčnik. 1.1.2024 – 30.6.2026

Photo: Željko Stevanić, IFP d.o.o

Laboratory for Hydraulic Machines LVTS

RESEARCH AREAS

Fluid mechanics • Turbine machines • Computer aided visualisation

DEPARTMENT HEAD Prof. dr. Marko Hočevar

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

ORIGINAL SCIENTIFIC ARTICLES

YU, Haidong, QUAN, Xiaobo, WEI, Haipeng, DULAR, Matevž, FU, Song. Development of a novel nonlinear dynamic cavitation model and its numerical validations. Advances in applied mathematics and mechanics. Jun. 2024, vol. 16, iss. 3, str. 771-804, ilustr. ISSN 2070-0733.

DREŠAR, Primož, HOČEVAR, Marko, BLAGOJEVIČ, Marko, BIZJAN, Benjamin. Numerical modeling of laminar free overfall in triangular channels. Ain Shams Engineering Journal. Apr. 2024, vol. 15, iss. 4, art. 102650, str. 1-11, ilustr. ISSN 2090-4495.

NOVAK, Lovrenc, ŠIROK, Brane, ZUPANC, Mojca, HOČEVAR, Marko. Effects of layer inhomogeneities on the process of sewage sludge convective drying. Drying technology. [Print ed.]. Jan. 2024, vol. 42, iss. 1, str. 34-47, ilustr. ISSN 0737-3937.

ROSSELLÓ, Juan Manuel, HOEPPE, Hannes P., KOCH, Max, LECHNER, Christiane, OSTERHOFF, Markus, VASSHOLZ, Malte, HAGEMANN, Johannes, MÖLLER, Johannes, SCHOLZ, Markus, BOESENBERG, Ulrike, et al. Jetting bubbles observed by x-ray holography at a free-electron laser : internal structure and the effect of non-axisymmetric boundary conditions. Experiments in fluids. Feb. 2024, vol. 65, article no. 20, str. 1-26, ilustr. ISSN 0723-4864.

BIZJAN, Benjamin, HOČEVAR, Marko, KOLBL REPINC, Sabina, RAK, Gašper. On the effect of aeration on laser ranging measurements of free water surface. Flow measurement and instrumentation. Feb.

Photo: Željko Stevanić, IFP d.o.o

2024, vol. 95, [article no.] 102502, str. 1-8, ilustr. ISSN 0955-5986.

BIZJAN, Benjamin, RAK, Gašper, KOLBL REPINC, Sabina, ROPRET, Polonca, KOSEL, Janez. Inactivation of MS-2 virus in water by rotational generator of hydraulic shock. Heliyon. Nov. 2024, vol. 10, iss. 21, [article no.] e34037, str. 1-11, ilustr. ISSN 2405-8440.

REESE, Hendrik, OHL, Claus-Dieter, ROSSELLÓ, Juan Manuel. Cavitation and jetting from shock wave refocusing near convex liquid surfaces. International journal of multiphase flow. May 2024, vol. 175, [article no.] 104822, str. 1-5, ilustr. ISSN 1879-3533.

OHL, Siew-Wan, ROSSELLÓ, Juan Manuel, FUSTER, Daniel, OHL, Claus-Dieter. Finite amplitude wave propagation through bubbly fluids. International journal of multiphase flow. Jun. 2024, vol. 176, [article no.] 104826, str. 1-9, ilustr. ISSN 1879-3533.

NOVAK, Lovrenc, MALNERŠIČ, Aleš, HOČEVAR, Marko. Quantification of fiber shedding from cotton fabrics during drying in a domestic heat pump tumble dryer. Journal of natural fibers. 2024, vol. 21, no. 1, [artical no.] 2375520, str. 1-23. ISSN 1544-046X.

ÖZDEN, Ipeknaz, VUKŠIĆ, Milan, DULAR, Matevž, IVEKOVIĆ, Aljaž, KOCJAN, Andraž. Tuning the rheological properties of paraffin-wax ceramic feedstocks for deposition with thermoplastic 3D printing. Journal of the European Ceramic Society. [Online ed.]. Okt. 2024, iss. 13, vol. 44, 7791-7800 str., ilustr. ISSN 1873-619X.

HOEPPE, Hannes Paul, OSTERHOFF, Markus, AGHEL MALEKI, Atiyeh, ROSSELLÓ, Juan Manuel, VASSHOLZ, Malte, HAGEMANN, Johannes, ENGLER, Thea, SCHWARZ, Daniel, RODRIGUEZ-FERNANDEZ, Angel, BOESENBERG, Ulrike, et al. The collapse of a sonoluminescent cavitation bubble imaged with X-ray free-electron laser pulses. New journal of physics. [Online ed.]. Mar. 2024, vol. 26, [article no.] 033002, str. 1-14, ilustr. ISSN 1367-2630.

ZEVNIK, Jure, PATFOORT, Julien, ROSSELLÓ, Juan Manuel, OHL, Claus-Dieter, DULAR, Matevž. Dynamics of a cavitation bubble confined in a thin liquid layer at null Kelvin impulse. Physics of fluids. Jun. 2024, vol. 36, iss. 6, [art.] 063340, str. 1-20, ilustr. ISSN 1070-6631.

VAGNONI, Elena, GEZER, Dogan, ANAGNOSTOPOULOS, Ioannis, CAVAZZINI, Giovanna, DOUJAK, Eduard, HOČEVAR, Marko, RUDOLF, Pavel. The new role of sustainable hydropower in flexible energy systems and its technical evolution through innovation and digitalization. Renewable energy. [Print ed.]. Sept. 2024, vol. 320, [article no.] 120832, str. 1-11, ilustr. ISSN 0960-1481.

MORALES ARTEAGA, Juan Francisco, VODNIK, Dominik, KASTELEC, Damijana, ZUPANC, Mojca, DULAR, Matevž, ORTAR, Jernej, ĐURIĆ, Marija, KAURIN, Anela, MIHELIČ, Rok, LEŠTAN, Domen. Removal of toxic metals from sewage sludge by EDTA and hydrodynamic cavitation and use of the sludge as fertilizer. Science of the total environment. 2024, vol. 923, art. no171444, 10 str., ilustr. ISSN 0048-9697.

SHARMA, Yatha, OHL, Claus-Dieter, ROSSELLÓ, Juan Manuel. Nanobubble nucleation by pulsed laser illumination of colloidal gold nanoparticles. Scientific reports. 2024, vol. 14, [art. no.] 30491, 12 str., ilustr. ISSN 2045-2322.

ROSSELLÓ, Juan Manuel, GHASEMIAN, Saber Izak, OHL, Claus-Dieter. High-speed ultrasound imaging of bubbly flows and shear waves in soft matter. Soft matter. Jan. 2024, vol. 20, iss. 4, str. 823–836, ilustr. ISSN 1744-6848.

DULAR, Matevž, BARRAGAN MONTALVO, Guillermo Enrique, HOČEVAR, Marko, NOVAK, Lovrenc, OHL, Claus-Dieter, PETKOVŠEK, Martin. Questioning the ASTM G32-16 (stationary specimen) standard cavitation erosion test. Ultrasonics sonochemistry. Jul. 2024, vol. 107, [article no.] 106930, str. 1-10, ilustr. ISSN 1350-4177.

BLAGOJEVIČ, Marko, BIZJAN, Benjamin, ZUPANC, Mojca, GOSTIŠA, Jurij, SLEMENIK PERŠE, Lidija, GRADIŠAR CENTA, Urška, STRES, Blaž, NOVAK, Uroš, LIKOZAR, Blaž, RAK, Gašper, KOLBL REPINC, Sabina. Preliminary analysis - effect of a rotary generator of hydrodynamic cavitation on rheology and methane yield of wastewater sludge. Ultrasonics sonochemistry. jul. 2024, vol. 107, str. 1-12, ilustr. ISSN 1350-4177.

BOČEK, Žan, PETKOVŠEK, Martin, CLARK, Samuel J., FEZZAA, Kamel, DULAR, Matevž. Kelvin-Helmholtz instability as one of the key features for fast and efficient emulsification by hydrodynamic cavitation. Ultrasonics sonochemistry. Aug. 2024, vol. 108, [article no.] 106970, str. 1-9, ilustr. ISSN 1350-4177.

ZUPANC, Andraž, PETKOVŠEK, Martin, ZDOVC, Blaž, ŽAGAR, Ema, ZUPANC, Mojca. Degradation of hydroxypropyl methylcellulose (HPMC) by acoustic and hydrodynamic cavitation. Ultrasonics Sonochemistry. [Online ed.]. Oct. 2024, vol. 109, art. 107020, str. 1-9, ilustr. ISSN 1873-2828.

WU, Xiaoge, YANG, Su, LI, Wenshu, WANG, JuanJuan, DULAR, Matevž, TAN, Xiao. Improving Microcystis aeruginosa removal efficiency through enhanced sonosensitivity of nitrogen-doped nanodiamonds. Ultrasonics sonochemistry. Oct. 2024, vol. 109, [articel no.] 106993, str. 1-14, ilustr. ISSN 1350-4177.

ZUPANC, Mojca, PRIMC, Gregor, DULAR, Matevž, PETKOVŠEK, Martin, ROŠKAR, Robert, ZAPLOTNIK, Rok, TRONTEL], Jurij. Proof-of-concept for removing micropollutants through a combination of sub-atmospheric-pressure non-thermal plasma and hydrodynamic (super)cavitation. Ultrasonics Sonochemistry. [Online ed.]. Dec. 2024, vol. 111, [art. no.] 107110, str. 1-12, ilustr. ISSN 1873-2828.

BLAGOJEVIČ, Marko, HOČEVAR, Marko, BIZJAN, Benjamin, DREŠAR, Primož, KOLBL REPINC, Sabina, RAK, Gašper. Three-Dimensional Numerical Simulation of a Two-Phase Supercritical Open Channel Junction Flow. Water. 2024, vol. 16, iss. 12, article no. 1757, str. 1-18, ilustr. ISSN 2073-4441.

PATENT

OHL, Claus-Dieter, ROSSELLÓ, Juan Manuel. Verfahren und Vorrichtung zur Partikeldetektion : Patentschrift DE 10 2023 100 673 B3, 2024-06-13. [Munich]: Deutsches Patent- und Markenamt, 2024.

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

STEPHAN, Markus, BACHERT, Bernd, DULAR, Matevž. Wiley-Schnellkurs Strömungsmechanik. 1. Aufl. Weinheim: Wiley-VCH, 2024.

PROJECTS

Horizon 2020 – ERC. CABUM. An investigation of the mechanisms at the interaction between cavitation bubbles and contaminants. Matevž Dular. 1.7.2018 – 31.3.2024

Slovenian Research and Innovation Agency. eCATS. Controlling extreme cavitation conditions by laser tailoring of surface functionalities. Martin Petkovšek. 1.10.2021 - 30.9.2024

Slovenian Research and Innovation Agency. Controlled generation of microbubbles and exploration of their physics for exploitation in chemistry, biology and medicine. Matevž Dular. 01.10.2021 - 30.9.2024

Slovenian Research and Innovation Agency. Low emission household tumble drying with evaluation of damage to textile materials Marko Hočevar. 1.10.2021 - 30.9.2024

Horizon Europe. H-HOPE. Hidden Hydro Oscillating Power for Europe. Marko Hočevar. 1.11.2022 - 31.10.2026

Horizon Europe. CAVIPHY. Exploitation of extreme cavitation conditions for wastewater treatment. Matevž Dular. 1.8.2022 - 31.1.2024

Horizon Europe. NASCAP. Nanobubbles Stabilization for Cleaning Applications. Matevž Dular. 20.6.2022 – 19.6.2024

COST. NEXUSNET. Network on water-energy-food nexus for a low- carbon economy in Europe and beyond. Marko Hočevar. 22.9.2021-21.9.2025COST. PEN@Hydropower. Pan-European Network for Sustainable Hydropower. Marko Hočevar. 14.9.2022-13.9.2026

Erasmus+. EVERYONE. Exchange of renewable energy harvesting experience in Europe for improving competence of young engineers. Marko Hočevar. 1.9.2023-28.2.2026

Ministry of Agriculture, Forestry and Food – EIP. MOTIKA. Pospešeno okopavanje zelenjave. Marko Hočevar. 19.5.2022 - 18.5.2025

Slovenian Research and Innovation Agency. Causma. Removal of selected antimicrobials by plasma-cavitation hybrid technology from water matrices of varying complexity. Martin Petkovšek. 1.10.2022

- 30.9.2025

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Marko Hočevar. 1.1.2024 – 30.6.2026

Slovenian Research and Innovation Agency. Bubbles interacting with four states of matter. Matevž Dular. 1.9.2024 - 31.8.2027

Slovenian Research and Innovation Agency. Curious. Curious Case of Imploding Cavitation Bubbles: Fast Jets and Where to Find Them? Jure Zevnik. 1. 10. 2023 – 30. 9. 2025

Erasmus+. Acting4Water. Tackling water scarcity by using advanced technologies in business-academia-society cooperation. Martin Petkovšek, Mojca Zupanc. 1.10.2023 – 31.3.2026

AWARDS AND ACHIEVEMENTS

Prof. Dr. Matevž Dular and Assist. Prof. Dr. Martin Petkovšek, together with other experts from the Institute “Jožef Stefan” and the National Institute of Biology received the "Excellent in Science" award for the development of an innovative method and device for the disinfection of liquids using cold plasma in a stable supercavitation bubble, which has also been validated by a US patent (US Patent 11,807,555 B2)

Assist dr. Jure Zevnik received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements.

Photo: UL FME Archive

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. dr. Jurij Prezelj
DEPARTMENT MEMBERS Assist. Luka Čurović, Assist. Prof. dr. Jure Murovec, Assist. Železnik Anže, Assist. Nejc Cerkovnik, Andrej Hvastja, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

NOVAKOVIĆ, Tadej, ČUROVIĆ, Luka, HOČEVAR, Marko, PREZEL], Jurij. Impact of geometric modifications of small axial fans on psychoacoustic metrics. Applied Acoustics. [Online ed.]. Mar. 2024, vol. 218, [article no.] 109913, str. 1-15, ilustr. ISSN 1872-910X.

ČUROVIĆ, Luka, MUROVEC, Jure, ŽELEZNIK, Anže, PREZEL], Jurij. Estimation of sound absorption coefficient at modal frequencies using decay time measurements and eigenvalue model in a small room. Journal of low frequency noise, vibration, and active control. 2024, vol. 43, iss. 4, str. 1530-1544, ilustr. ISSN 2048-4046.

PREZEL], Jurij, NOVAKOVIĆ, Tadej, ČUROVIĆ, Luka, ŽELEZNIK, Anže, MUROVEC, Jure. An energy-efficient vacuum system as an alternative to the inefficient use of compressed air for the yarn suction gun. The journal of the Textile Institute. 2024, vol. 115, iss. 3, str. 460-470, ilustr. ISSN 1754-2340.

MILIVOJČEVIĆ, Marko, ĆIRIĆ, Dejan, PREZEL], Jurij, MUROVEC, Jure. Analysis of unsupervised learning approach for classification of vehicle fuel type using psychoacoustic features. Measurement. [Online ed.]. Mar. 2024, vol. 227, [article no.] 114318, str. 1-17, ilustr. ISSN 1873-412X.

PROJECTS

Slovenian Research and Innovation Agency. Acoustic monitoring of urban noise and biodiversity for green future using IoT-Sound-Radar and AI for event classification. Jurij Prezelj. 1.10.2023 – 30.9.2026

Slovenian Research and Innovation Agency, Ministry of Environment, Spatial Planning and Energy. Managing low-frequency noise in promoting the use of renewable energy sources. Jurij Prezelj. 1.10.2024 – 31.7.2027

Slovenian Research and Innovation Agency. Sustainable Environmental Solutions: Spatial Domain as the Future of Noise Monitoring (Z7-60185). Nosilec: doc.dr. Jure Murovec, 2024-2026

DOCTORAL DISSERTATION

Luka Čurovič, Characterization of sound field modes decay below Schroeder frequency: doctoral thesis. Mentor: Assoc.prof.dr Jurij Prezelj

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.

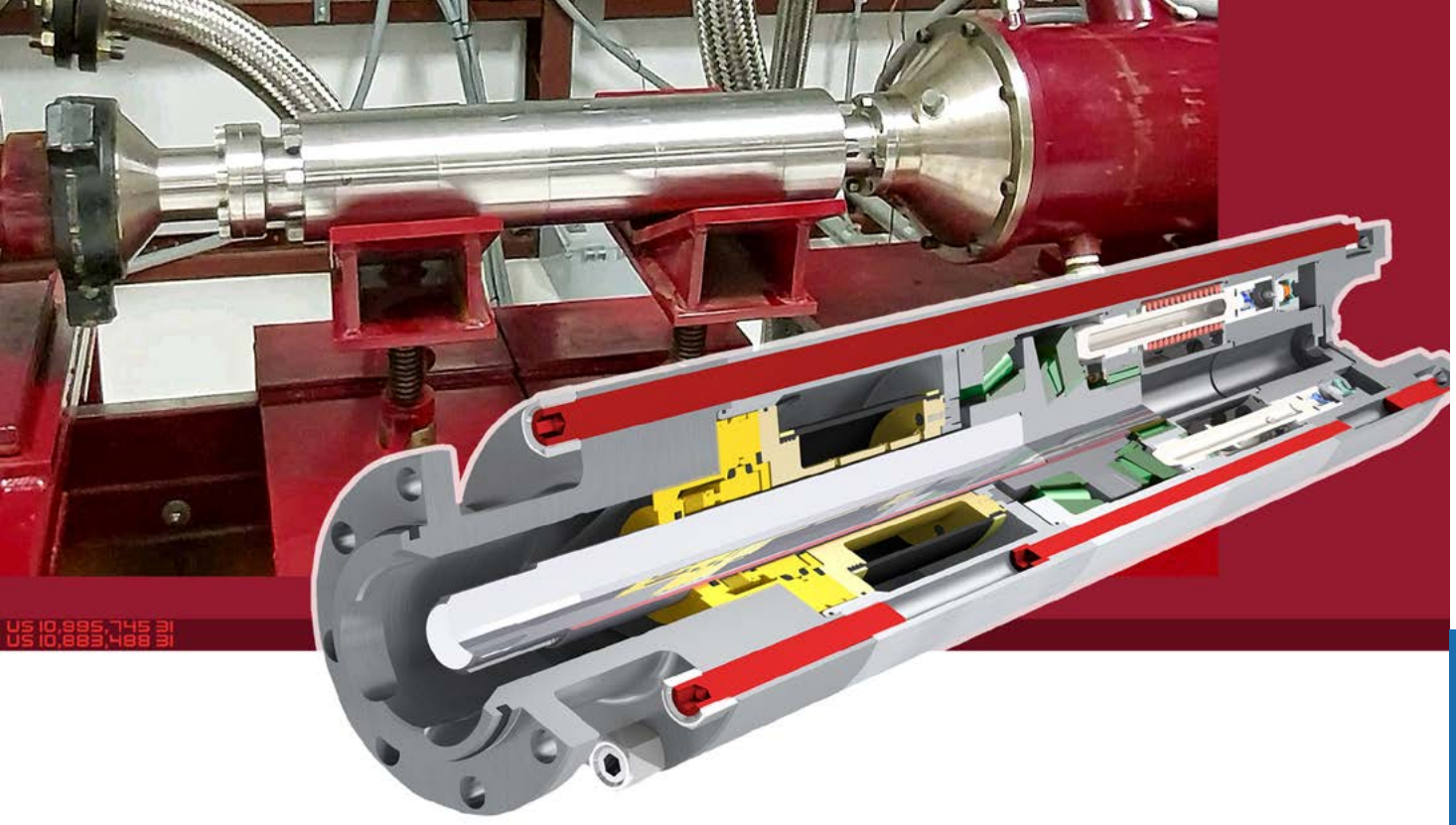


Photo: LASEM Archive

Laboratory for Machine Elements LASEM

RESEARCH AREAS

Machine element • Operational strength • Development evaluations

DEPARTMENT HEAD Prof. dr. Marko Nagode
DEPARTMENT MEMBERS Assist. Prof. dr. Simon Oman, Assist. dr. Ivan Okorn, Assist. Tadej Kocjan, Assist. dr. Branislav Panić, Asisst. dr. Andrej Škrlec, Assit. Sanel Avdić, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

NAGODE, Marko, KLEMENC, Jernej, OMAN, Simon, ŠERUGA, Domen. Elasto-viscoplastic material modelling using the multiaxial Prandtl operator approach. International journal of mechanical sciences. 2024, vol. 267, [article no.] 108953, str. 1-16, ilustr. ISSN 1879-2162.

OKORN, Ivan, NAGODE, Marko, KLEMENC, Jernej, OMAN, Simon. Influence of geometric imperfections of flange joints on the fatigue load of preloaded bolts. International journal of pressure vessels and piping. Aug. 2024, vol. 210, [art.] 105237, str. 1-16, ilustr. ISSN 1879-3541.

PANIĆ, Branislav, BOROVINŠEK, Matej, VESENJAK, Matej, OMAN, Simon, NAGODE, Marko. A guide to unsupervised image segmentation of mCT-scanned cellular metals with mixture modelling and Markov random fields. Materials & design. Mar. 2024, vol. 239, [art.] 112750, str. 1-13, ilustr. ISSN 1873-4197.

ŠKRLEC, Andrej, KOCJAN, Tadej, NAGODE, Marko, KLEMENC, Jernej. Modelling a response of complex-phase steel at high strain rates. Materials. May 2024, vol. 17, iss. 10, [article no.] 2302, str. 1-18, ilustr. ISSN 1996-1944.

ŠKRLEC, Andrej, PANIĆ, Branislav, NAGODE, Marko, KLEMENC, Jernej. Estimating the Cowper–Symonds parameters for high-strength steel using DIC combined with integral measures of deviation. Metals. 2024, vol. 14, iss. 9, [article no.] 992, str. 1-20, ilustr. ISSN 2075-4701.

AVDIĆ, Sanel, NAGODE, Marko, KLEMENC, Jernej, OMAN, Simon. Experimental evaluation of a granular damping element. Polymers. May 2024, vol. 16, iss. 10, [article no.] 1440, str. 1-16, ilustr. ISSN 2073-4360.

PROJECTS

Texas Institute of Science. Downhole Pump: Modification of Pump version V1 for Field Test. Simon Oman. 20.3.2023 - 31.12.2024

European Space Agency ESA. SV-CompReUse. Predicting residual service life of sandwich composites for reusable space vehicles. Marko Nagode. 1.6.2024 – 31.8.2025

Emri d.o.o. TIantie- vibroizolacija tirov na betonski plošči. Simon Oman. 4.7.2023 – 3.2.2024

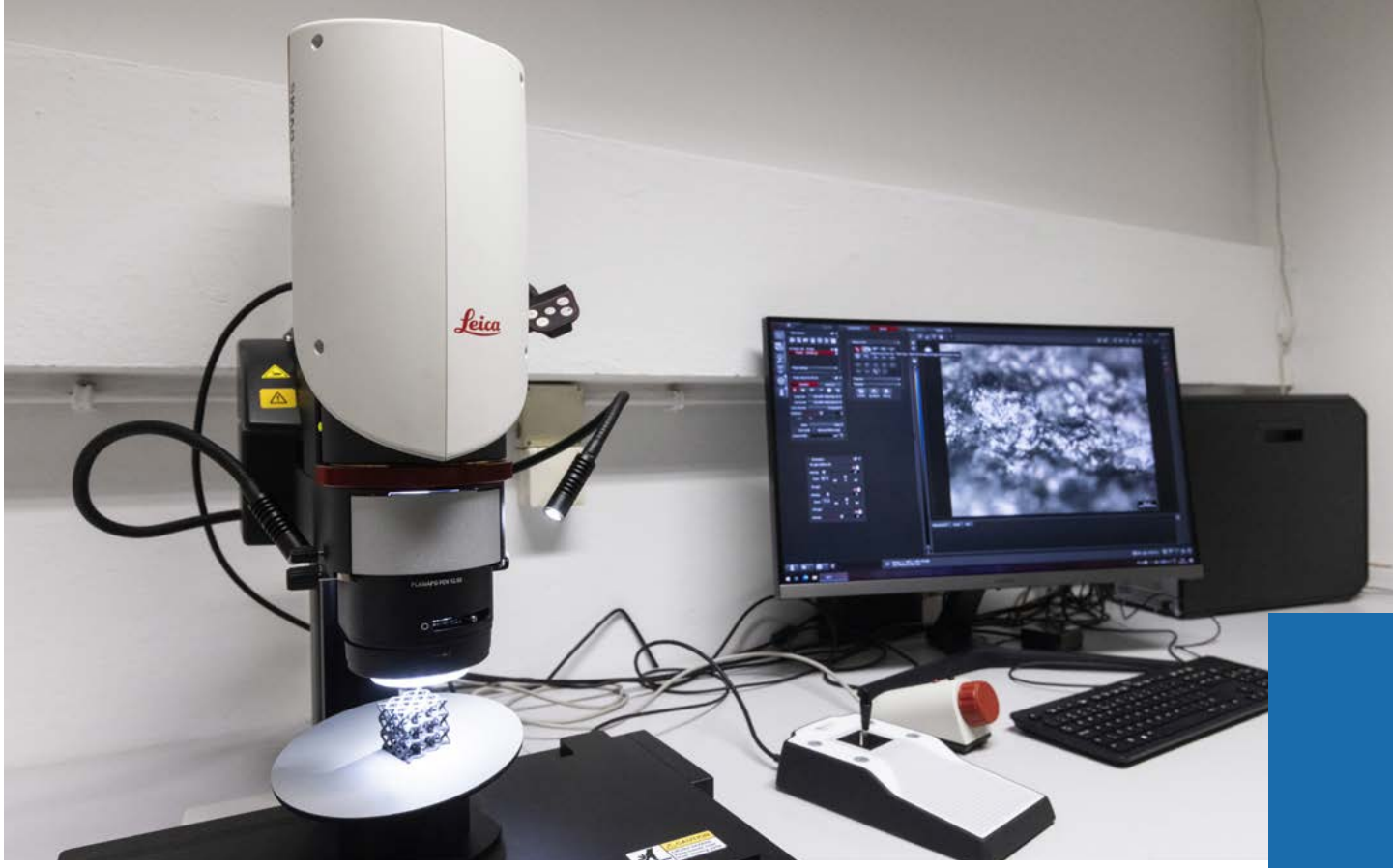


Photo: Željko Stevanić, IFP d.o.o

Laboratory for Structure Evaluation LAVEK

RESEARCH AREAS

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

DEPARTMENT HEAD Prof. dr. Jernej Klemenc

DEPARTMENT MEMBERS Assoc. Prof. dr. Domen Šeruga, Assist. dr. Dejan Tomažinčič, Assist. dr. Peter Zobec, Assist. dr. Aleš Gosar, Assist. Jure Kajbič, Assist. Aljaž Litrop, Nikonov Anatolij, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

KLEMENC, Jernej, NAGODE, Marko. Sensitivity of step-stress accelerated fatigue-life tests on type I censored data : an engineering perspective. Fatigue & fracture of engineering materials & structures. 2024, vol. 7, iss. 2, str. 397-412, ilustr. ISSN 1460-2695.

LITROP, Aljaž, KLEMENC, Jernej, NAGODE, Marko, ŠERUGA, Domen. Enhanced cyclically stable plasticity model for multiaxial behaviour of magnesium alloy AZ31 under low-cycle fatigue conditions. Materials. Sep 2024, vol. 17, iss. 18, [article no.] 4659, str. 1-22, ilustr. ISSN 1996-1944.

ŠERUGA, Domen, WOLBERS, Martijn, KLEMENC, Jernej, NAGODE, Marko, OMAN, Simon. Consideration of surface roughness during the design of internal structures for fluid transport produced by additive manufacturing of PEEK. Mechanics based design of structures and machines. [Online ed.]. 2024, vol. 52, iss. 12, str. 9655-9668, ilustr. ISSN 1539-7742.

NIKONOV, Anatolij, NAGODE, Marko, KLEMENC, Jernej, EMRI, Igor. Effect of weight on dynamic ropes' responses in indoor climbing. Proceedings of the Institution of Mechanical Engineers. Part P, Journal of sports engineering and technology (Print). 2024, str. 1-8, ilustr. ISSN 1754-3371.

TOMAŽINČIČ, Dejan, ZOBEC, Peter, VRH, Marko, GOSAR, Aleš, ŠVEGEL], Jurij, MUC, Matic, MALNARIČ, Vili, KLEMENC, Jernej, ŠERUGA, Domen. Durability prediction of cyclically loaded CP-W800 fillet welds. Solids. 2024, vol. 5, iss. 1, str. 84–97, ilustr. ISSN 2673-6497.

GOSAR, Aleš, KLEMENC, Jernej, NAGODE, Marko, OMAN, Simon. On the importance of the experimental setup design in hydrodynamic journal bearing friction measurement. Tribology international. Sep. 2024, vol. 197, [article no.] 109800, str. 1-13, ilustr. ISSN 0301-679X.

PROJECTS

Emri d.o.o. TIantie- vibroizolacija tirov na betonski plošči. Jernej Klemenc. 4.7.2023 – 3.2.2024

Slovenian Research and Innovation Agency. Development of a cellular composite with the ability to transform cells by a selected activation mechanism. Z2-50081. Dejan Tomažinčič. 1.10.2023 - 30.9.2025

European Space Agency ESA. SV-CompReUse. Predicting residual service life of sandwich composites for reusable space vehicles. Jernej Klemenc. 1.6.2024 – 31.8.2025

Texas Institute of Science. Downhole Pump: Modification of Pump version V1 for Field Test. Jernej Klemenc. 20.3.2023 - 31.12.2024

Slovenian Research and Innovation Agency. Experimental and numerical analysis of static and fatigue double-side bending of rubber matrix composites. Jernej Klemenc. 1.1.2024 – 31.12.2026

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.

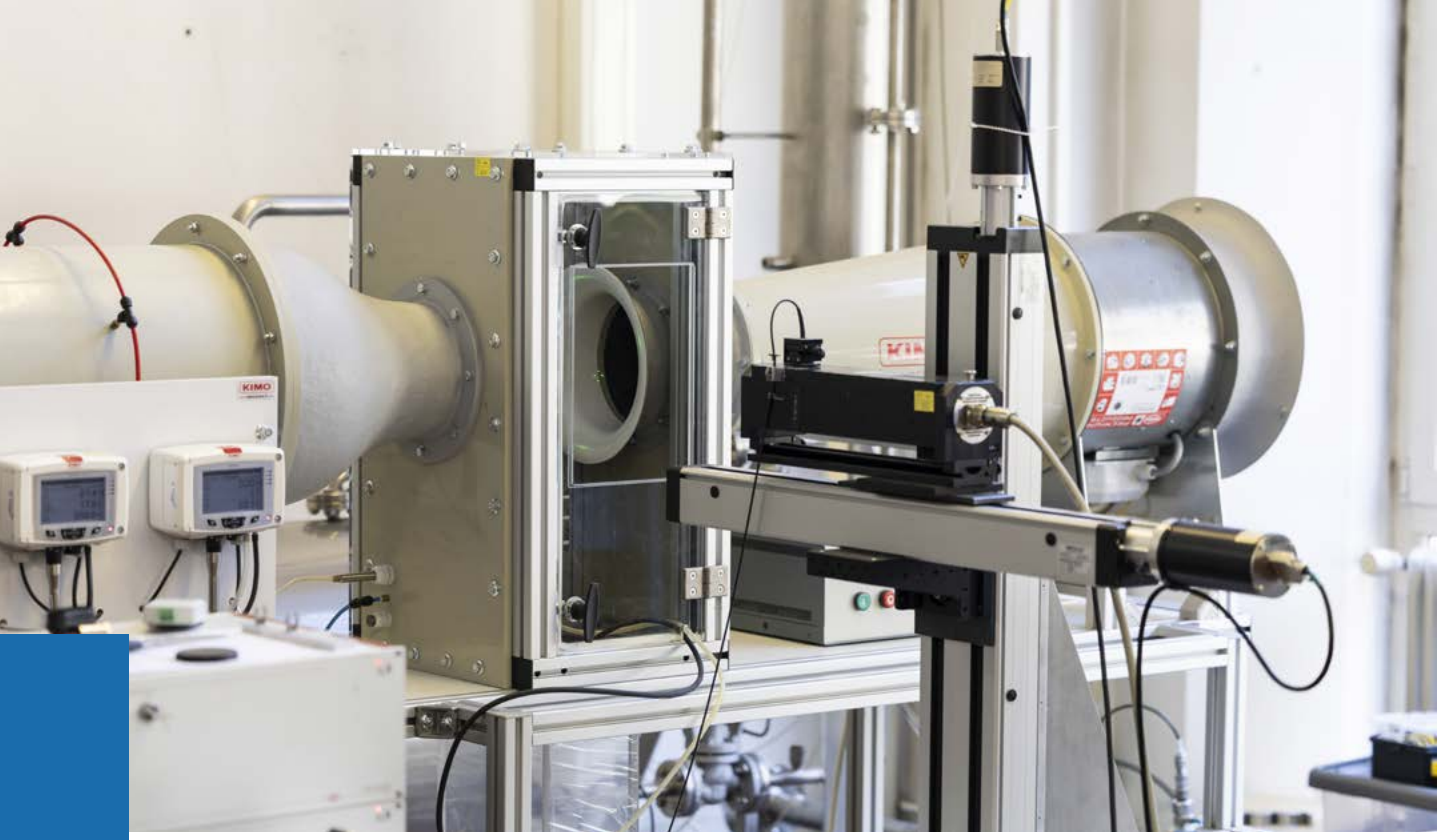


Photo: UL FME Archive

Laboratory for Measurements in Process Engineering LMPS

RESEARCH AREAS

Metrology • Primary and secondary measurement standards and procedures • Measurements in process and energy engineering • Experimental methods • Evaluation of uncertainty of measurements

DEPARTMENT HEAD Assoc. Prof. dr. Jože Kutin

DEPARTMENT MEMBERS Assist. Prof. dr. Gregor Bobovnik, Assist. Prof. dr. Andrej Svete, Assist. dr. Primož Žibret, Marjan Pohl, Peter Sambol, Urh Planko, Assist. Primož Žibret, Assist. Benjamin Novak, Zdenka Rupič, Katja Tajč, Zdenka Rupič

ORIGINAL SCIENTIFIC ARTICLES

HERNÁNDEZ CASTRO, Francisco Javier, KUTIN, Jože, SVETE, Andrej. Effects of the opening speed of the valve in a diaphragmless shock tube for metrological purposes. IEEE sensors journal. [Print ed.]. Jan. 2024, vol. 24, no. 1, str. 158-168, ilustr. ISSN 1530-437X.

KUTIN, Jože, BOBOVNIK, Gregor, MOLE, Nikolaj, SCHAKEL, Menne D., BÜKER, Oliver. Measurement corrections for temperature effects in Coriolis mass flow meters for cryogenic, liquid hydrogen (LH2LH2) applications. Measurement : journal of the International Measurement Confederation. [Print ed.]. Sep. 2024, vol. 237, [article no.] 115155, str. 1-13, ilustr. ISSN 0263-2241.

BÖCKLER, H.-B., DE HUU, M., MAURY, Rémy, SCHMELTER, S., SCHAKEL, Menne D., BÜKER, Oliver, KUTIN, Jože, BOBOVNIK, Gregor, WEDLER, C., TRUSLER, J. P. M., THOL, M., WEISS, S., GÜNZ, C., SCHUMANN, D., GUGOLE, F. Metrology infrastructure for high-pressure gas and liquified hydrogen flows : a brief outline of the MetHyInfra project, measurement challenges, and first results. Measurement. [Online ed.]. Jun. 2024, vol. 232, [article no.] 114675, str. 1-12, ilustr. ISSN 1873-412X.

KUTIN, Jože, SVETE, Andrej, GRGEC BERMANEC, Lovorka. Towards an optimal frequency and time response of singe-tube pressure measurement systems under continuum-flow conditions. Sensors and actuators. A, Physical. Feb. 2024, vol. 366, [article no. 114943], str. 1-11, ilustr. ISSN 0924-4247.

PROJECTS

Slovenian Research and Innovation Agency. Advanced shock tube system for high-frequency primary dynamic pressure calibration. J2-3054. Andrej Svete. 1.10.2021 - 30.9.2024

The European Association of National Metrology Institutes. MetHyInfra. Metrology infrastructure for high-pressure gas and liquified hydrogen flows. Jože Kutin. 1.6.2021 - 31.5.2024

European Partnership on Metrology. Met4H2. Metrology for the hydrogen supply chain. Gregor Bobovnik. 1.10.2022 – 30.9.2025

Hidria d.o.o. Eksperimentalno preskušanje odzivnega časa temperaturnih zaznaval za avtomobilske tehnologije. Jože Kutin. 27.2.2024 - 30.10.2024

Photo: Željko Stevanić, IFP d.o.o.

Laboratory for Heating Technology LTT

RESEARCH AREAS

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

DEPARTMENT HEAD Prof. dr. Iztok Golobič

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

ORIGINAL SCIENTIFIC ARTICLES

HADŽIĆ, Armin, MOŽE, Matic, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Superbiphilic laser-microengineered surfaces with a self-assembled monolayer coating for exceptional boiling performance. Advanced functional materials. [Online ed.]. Mar. 2024, vol. 34, iss. 10, [article no.] 2310662, str. 1-14, ilustr. ISSN 1616-3028.

ZUPANČIČ, Matevž, FONTANAROSA, Donato, MOŽE, Matic, BUCCI, Mattia, VODOPIVEC, Matevž, NAGARAJAN, Balasubramanian, VETRANO, Maria Rosaria, CASTAGNE, Sylvie, GOLOBIČ, Iztok. Enhanced nucleate boiling of Novec 649 on thin metal foils via laser-induced periodic surface structures. Applied thermal engineering. Jan. 2024, vol. 236, pt. d, str. 1-13, ilustr. ISSN 1359-4311.

BERCE, Jure, ARHAR, Klara, HADŽIĆ, Armin, ZUPANČIČ, Matevž, MOŽE, Matic, GOLOBIČ, Iztok. Boiling-induced surface aging and crystallization fouling of functionalized smooth and laser-textured copper interfaces. Applied thermal engineering. Apr. 2024, vol. 242, [article no.] 122540, str. 1-17, ilustr. ISSN 1359-4311.

BUCCI, Mattia, BERCE, Jure, ZUPANČIČ, Matevž, MOŽE, Matic, GOLOBIČ, Iztok. Dry spot propagation during boiling crisis on thin metal heaters. Applied thermal engineering. Dec. 2024, vol. 257, part a, [article no.] 124207, str. 1-12, ilustr. ISSN 1359-4311.

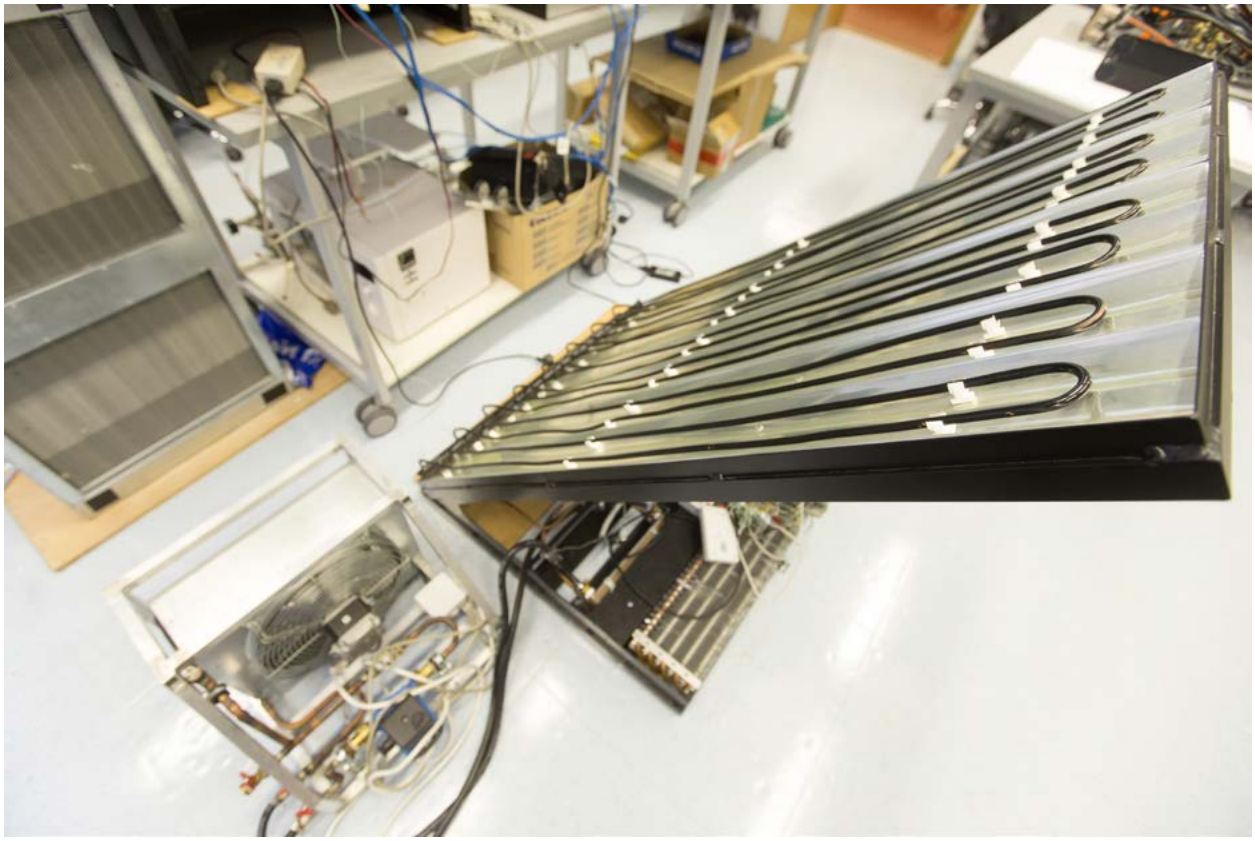


Photo: Željko Stevanić, IFP d.o.o.

ŽALEC, Domen, MOŽE, Matic, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Elucidating the effects of surface wettability on boiling heat transfer using hydrophilic and hydrophobic surfaces with laser-etched microchannels. Case studies in thermal engineering. May 2024, vol. 57, [article no.] 104357, str. 1-17, ilustr. ISSN 2214-157X.

BURES, Lubomir, BUCCI, Mattia, SATO, Yohei, BUCCI, Matteo. A coarse grid approach for single bubble boiling simulations with the volume of fluid method. Computers & Fluids. [Print ed.]. Mar. 2024, vol. 271, [article no.] 106182, str. 1-16, ilustr. ISSN 0045-7930.

BAHČ, Gregor, PREBILIČ, Vladimir, ZUPANČIČ, Matevž, MIHELIČ, Igor, GOLOBIČ, Iztok. Strategy and performance of biomethane production through woody biomass gasification, electrolysis and methanation : a case study for Kočevje region in Slovenia. Forests. [Online ed.]. 2024, vol. 15, issue 12, [article no.] 2205, 19 str., ilustr. ISSN 1999-4907.

MATA, Mario R., MOŽE, Matic, HADŽIĆ, Armin, LEE, Giseop, NACCARATO, Blake, BERK, Isaac, GOLOBIČ, Iztok, CHO, H. Jeremy. Changes in boiling controlled by molar concentration-dependent diffusion of surfactants. International journal of heat and mass transfer. Nov. 2024, vol. 233, art. 126008, str. 1-21, ilustr. ISSN 1879-2189.

ŽALEC, Domen, HADŽIĆ, Armin, MOŽE, Matic, GOLOBIČ, Iztok. Hierarchical surfaces with open microchannels and laser-induced microcavities for enhancement of pool boiling critical heat flux. International journal of heat and mass transfer. Dec. 2024, vol. 235, [article no.] 126192, str. 1-12, ilustr. ISSN 1879-2189.

HADŽIĆ, Armin, MOŽE, Matic, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Inherent scatter in pool boiling critical heat flux on reference surfaces. International journal of thermal sciences. Oct. 2024, vol. 204, [article no.] 109240, str. 1-10, ilustr. ISSN 1290-0729.

RODIČ, Peter, MOŽE, Matic, GOLOBIČ, Iztok, MILOŠEV, Ingrid. Functionalisation of the aluminium surface by cucl2 chemical etching and perfluoro silane grafting : enhanced corrosion protection and improved anti-icing behaviour. Metals. 2024, vol. 14, iss. 10, art. 1118, str. 1-20, ilustr. ISSN 2075-4701.

BERCE, Jure, HADŽIĆ, Armin, MOŽE, Matic, ARHAR, Klara, GJERKEŠ, Henrik, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Effect of surface wettability on nanoparticle deposition during pool boiling on laser-textured copper surfaces. Nanomaterials. [Online ed.]. Feb. 2024, vol. 14, iss. 3, [article no.] 311, str. 1-17, ilustr. ISSN 2079-4991.

HADŽIĆ, Armin, MOŽE, Matic, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Aluminum micropillar surfaces with hierarchical micro- and nanoscale features for enhancement of boiling heat transfer coefficient and critical heat flux. Nanomaterials. [Online ed.]. Apr. 2024, vol. 14, iss. 8, [article no.] 667, str. 1-19, ilustr. ISSN 2079-4991.

SHANG, Yuheng, MOŽE, Matic, TANSU AKSOY, Yunus, CASTAGNE, Sylvie, SEVENO, David, GOLOBIČ, Iztok, VETRANO, Maria Rosaria. Effect of surface wettability on dynamic behaviors and freezing mechanisms of water droplets impacting cold surfaces.

PREBILIČ, Vladimir, MOŽE, Matic, GOLOBIČ, Iztok. Waste-to-energy processes as a municipality-level waste management strategy : a case study of Kočevje, Slovenia. Processes. [Online ed.]. May 2024, vol. 12, issue 5, [article no.] 1010, 27 str., ilustr. ISSN 2227-9717.

RODIČ, Peter, KOVAČ, Nina, KRAL], Slavko, JEREB, Samo, GOLOBIČ, Iztok, MOŽE, Matic, MILOŠEV, Ingrid. Anti-corrosion and anti-icing properties of superhydrophobic laser-textured aluminum surfaces. Surface & coatings technology. [Print ed.]. 2024, vol. 494, art. 131325, str. 1-15, ilustr. ISSN 0257-8972.

DOCTORAL DISSERTATION

HADŽIĆ, Armin. Development of structured surfaces for high heat flux nucleate boiling : doctoral thesis. Mentor: Iztok Golobič, comentor: Matic Može.

BERCE, Jure. Vpliv nečistoč na učinkovitost ploščnega prenosnika toplote : doktorsko delo. Mentor: Iztok Golobič, comentor: Matevž Zupančič.

PROJECTS

Slovenian Research and Innovation Agency. BEST. Boiling Enhancement by Surface Texturing. Iztok Golobič. 1.1.2022 - 31.12.2025

Slovenian Research and Innovation Agency. DroBFuSE. Interfacial phenomena of droplets and bubbles on functionalized surfaces investigated by advanced diagnostics for future environmental and enhanced heat transfer applications. Matevž Zupančič. 1.10.2023 - 30.9.2026

European Defence Agency. AMALIA. Additive Manufacturing of Metallic Auxetic Structures and Materials for Lightweight Armour. Iztok Golobič. 20.10.2022 - 19.10.2025

Slovenian Research and Innovation Agency. HyBReED. Development of resilient chemical energy storage with hydrogen and batteries. Iztok Golobič. 1.1.2024 – 30.6.2026

Krka d.d. Raziskava zanesljivosti obstoječe oskrbe s pitno vodo za lokacijo Ločna. Matevž Zupančič. 9.4.2024 - 31.10.2024

Krka d.d. Raziskava dodatnih virov pitne vode (lastni vir pitne vode – vrtina ali zajetje, priprava pitne vode iz reke Krke). Matic Može. 9.4.2024 - 31.10.2024

AWARDS AND ACHIEEMENTS

Assist. Prof. Dr. Matic Može was awarded The Jožef Stefan Golden Emblem to the most outstanding doctoral theses in the fields of natural sciences, mathematics, engineering, medicine, and biotechnology over the last three years.

Assist. Samo Jereb received an award of the Faculty of Mechanical Engineering for excellence in teaching.

Photo: Željko Stevanić, IFP d.o.o

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. dr. Andrej Kitanovski
DEPARTMENT MEMBERS Assist. Prof. dr. Jaka Tušek, Assist. dr. Dall`Olio Stefano, Assist. dr. Urban Tomc, Assist. dr. Žiga Ahčin, Assist. prof. dr. Katja Klinar, Sr. Dev. Nada Petelin, Assist. dr. Miha Bobič, Simon Bogić, Assist. Jan Cerar, Assist. Katja Vozel, Perne Jakob, Assist. Tomaž Pšeničnik, Assist. Blaž Velkavrh, Assist. Mihael Blatnik, Assist. Matevž Cimermančič, Darja Jeločnik, Nika Nežič

ORIGINAL SCIENTIFIC ARTICLES

KLINAR, Katja, LAW, Jia Yan, FRANCO, Victorino, MOYA, Xavier, KITANOVSKI, Andrej. Perspectives and energy applications of magnetocaloric, pyromagnetic, electrocaloric, and pyroelectric materials. Advanced energy materials. Oct. 2024, vol. 14, iss. 39, art. 2401739, str. 1-36, ilustr. ISSN 1614-6840.

TOMC, Urban, NOSAN, Simon, VIDRIH, Boris, BOGIĆ, Simon, NAVICKAITE, Kristina, VOZEL, Katja, BOBIČ, Miha, KITANOVSKI, Andrej. Small demonstrator of a thermoelectric heat-pump booster for an ultra-low-temperature district-heating substation. Applied energy. May 2024, vol. 361, [article no.] 122899, str. 1-14, ilustr. ISSN 1872-9118.

OTTEN, Simon, GAČNIK, Darja, BRÜGGENWIRTH, Sjoerd, KATE, Herman J. ten, RIVENC, Jean, NILSSON, Emelie, et al. Calculation and measurement of transport AC loss of ReReBCO CORC cables for electric aircraft. IEEE transactions on applied superconductivity. May 2024, vol. 34, iss. 3, article no. 4703605, str. [1-5], ilustr. ISSN 1558-2515.

NILSSON, Emelie, RIVENC, Jean, ROUQUETTE, Jean-Francois, GAČNIK, Darja, KATE, Herman J. ten, et al. Performance of the 500 kW superconducting DC and AC links of the ASCEND Demonstrator at Airbus. IEEE transactions on applied superconductivity. May 2024, vol. 34, iss. 3, article no. 4801704, str. [1-4], ilustr. ISSN 1558-2515.

VELKAVRH, Blaž, TOMC, Urban, ŠADL, Matej, REGIS DE MORAES, Victor, KOBLAR, Maja, COLARIČ, Bianka, KITANOVSKI, Andrej, URŠIČ NEMEVŠEK, Hana. Preparation of dielectric layers for applications in digital microfluidic thermal switches. Informacije MIDEM. [Spletna izd.]. 2024, vol. 54, no. 3, str. 215-223, ilustr. ISSN 2232-6979.

VOZEL, Katja, KLINAR, Katja, PETELIN, Nada, KITANOVSKI, Andrej. TCCbuilder : an open-source tool for the analysis of thermal switches, thermal diodes, thermal regulators, and thermal control circuits. iScience. [Online ed.]. 2024, vol. 27, iss. 12, [art.] 111263, str. 1-15, ilustr. ISSN 2589-0042.

MELLO, V. D., GURGEL, A. A., QUEIROZ, F. G., SILVA, E. S. N., GIMAEV, Radel, ZVEREV, Vladimir I., et al. Magnetic thermal hysteresis in Dy thin films – experimental results and modeling. Journal of Magnetism and Magnetic Materials. [Print ed.]. Dec. 2024, vol. 600, [article no.] 172142, str. 1-8, ilustr. ISSN 0304-8853.

GURGEL, A. A., QUEIROZ, F. G., SILVA, E. S. N., GIMAEV, Radel, et al. Thermal hysteresis in Ho thin films – experimental results and modeling. Journal of Magnetism and Magnetic Materials. [Print ed.]. Nov. 2024, vol. 610 , [article no.] 172579, str. 1-10, ilustr. ISSN 0304-8853.

SMELOVA, Ekaterina M., TSYSAR, Kseniya M., GIMAEV, Radel, ZVEREV, Vladimir I. The effect of oxidation of vicinal Au surface on the magnetic properties of surface-supported Mn nanowire. Physica status solidi. B, Basic research. May 2024, vol. 261, iss. 5, [article no.] 2300532, str. 1-6, ilustr. ISSN 0370-1972.

RUMIANTSEV, Egor, KHRABROV, Kuzma, TSYPIN, Artem, GIMAEV, Radel, et al. Doping position estimation for FeRh-based alloys. Scientific reports. 2024, vol. 14, art. no. 20612, str. 1-8, ilustr. ISSN 2045-2322.

KOSHKIDKO, Yu. S., CWIK, J, SALAZAR MEJIA, C., GIMAEV, Radel, et al. Sublimed fine-grained dysprosium : significant magnetocaloric effect. Vacuum. [Print ed.]. Jul. 2024, vol. 225, [article no.] 113239, str. 1-10, ilustr. ISSN 0042-207X.

PATENT

KITANOVSKI, Andrej, TOMC, Urban, KLINAR, Katja, VALENTINČIČ, Joško, MAJDIČ, Franc, SABOTIN, Izidor, MENCINGER, Jure. Method for heat transfer in the embedded structure of a heat regenerator and the design thereof : United States patent US 12,000,663 B2, 2024-06-04. Alexandria: United States Patent and Trademark Office, 2024.

DOCTORAL DISSERTATION

PETELIN, Nada, KALIN, Mitjan. Trdninska toplotna stikala v sistemih s cikličnim spreminjanjem temperature : doktorsko delo. Mentor: Andrej Kitanovski, commentor: Mitjan Kalin

PROJECTS

Horizon Europe. INDY. Energy Independent and Efficient Deployable Military Camps. Andrej Kitanovski. 1.12.2022 - 31.1.2025

Horizon Europe. SENERGY NETS. Increase the Synergy among different ENERGY NETworkS. Andrej Kitanovski. 1.9.2022 - 31.8.2026

LIFE. LIFE21-CET-PDA-3DIVERSE Decentralization, Diversity and Dynamic load regulation – novel approaches to tangible energy transition with diversification of production sources. Andrej Kitanovski. 1.10.2022 - 30.9.2025

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

Gorenje d.o.o. Raziskovalno razvojno sodelovanje na področju toplotno snovnih procesov v gospodinjskih aparatih (Aneks 3). Andrej Kitanovski. 28.2.2024 - 1.3.2026MIZŠ - ERA-NET. Cool BatMan. Battery Thermal Managament System Based on High Power Density Digital Microfluidic Magnetocaloric Cooling. Urban Tomc. 1.11.2022 - 31.10.2025

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Andrej Kitanovski. 1.1.2024 – 30.6.2026

Horizon Europe. MAGCCINE. Clean and efficient cooling in vaccine transportation using Rotating Magnetocaloric Effect. Andrej Kitanovski. 1.10.2024 – 30.9.2028

Slovenian Research and Innovation Agency. Limited angle PET system. Andrej Kitanovski. 1.7.2024 – 30.6.2027

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Andrej Kitanovski. 1.1.2024 – 30.6.2026

AWARDS AND ACHIEVEMENTS

Prof. Dr. Andrej Kitanovski (holder), Assist. Prof. Dr. Katja Klinar, Assoc. Prof. Dr. Franc Majdič, Dr. Jure Mencinger, Assist. Prof. Dr. Izidor Sabotin, Assist. Dr. Urban Tomc and Assoc. Prof. Dr. Joško Valentinčič have developed an innovative heat regenerator Hypereg, which the University of Ljubljana has ranked among its most notable research achievements for 2024.

Assoc. Prof. Dr. Jaka Tušek was selected as an exceptional mentor 2024 by the University of Ljubljana.

Assist. Prof. Dr. Katja Klinar received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements.

Photo: Željko Stevanić, IFP d.o.o.

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. dr. Uroš Stritih
DEPARTMENT MEMBERS Assoc. Prof. dr. Matjaž Prek, Assist. dr. Eneja Osterman, Assist. Urška Mlakar, Assist. Ajda Kunavar, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

GRUDEN, Lucija, STRITIH, Uroš. Occupancy impact on air quality in repurposed museum space. Sanitarno inženirstvo. 2024, str. 1-11, ilustr. ISSN 1854-0678.

MLAKAR, Urška, KOŽEL], Rok, RISTIĆ, Alenka, STRITIH, Uroš. Experimental testing system for adsorption space heating. Strojniški vestnik. 28. 3. 2024, vol. 70, no. 3/4, str. 107-115, ilustr. ISSN 2536-3948.

PROJECTS

Horizon Europe. GeoS-TECHIS. Geothermal Source Thermal Energy for Cooling and Heating in Industries with Steam. Uroš Stritih. 1.10.2024 – 30.9.2027

Photo: Željko Stevanić, IFP d.o.o.

Laboratory for Sustainable Technologies in Buildings LOTZ

RESEARCH AREAS

Engineering sciences • Energy engineering • Renewable sources and technologies

DEPARTMENT HEAD Prof. dr. Sašo Medved

DEPARTMENT MEMBERS Assoc. Prof. dr. Ciril Arkar, Assist. dr. Eva Zavrl, Assists. Prof. dr. Primož Poredoš, Assist. MSc Suzana Domjan, Assist. Tej Žižak, Darja Jeločnik

ORIGINAL SCIENTIFIC ARTICLES

POREDOŠ, Primož, SHAN, He, WANG, Chenxi, CHEN, Zhihui, SHAO, Zhao, DENG, Fangfang, LIU, Haoran, YU, Jiaqi, WANG, Ruzhu. Radiative sky cooling thermal concentration with cooling power exceeding one kW per square meter. Energy & environmental science. Mar. 2024, vol. 17, iss. 6, str. 2336–2355, ilustr. ISSN 1754-5706.

POREDOŠ, Primož, GAO, Jintong, SHAN, He, YU, Jie, SHAO, Zhao, XU, Zhenyuan, WANG, Ruzhu. Ultra-high freshwater production in multistage solar membrane distillation via waste heat injection to condenser. Nature communications. 2024, vol. 15, art. 7890, str. 1-19, ilustr. ISSN 2041-1723.

SHAN, He, POREDOŠ, Primož, CHEN, Zhihui, YANG, Xinge, YE, Zhanyu, HU, Zhifeng, WANG, Ruzhu, TAN, Swee Ching. Hygroscopic salt-embedded composite materials for sorption-based atmospheric water harvesting. Nature reviews. Materials. 2024, vol. 9, str. 699-721, ilustr. ISSN 2058-8437.

SHAN, He, POREDOŠ, Primož, QU, Hao, YANG, Xinge, ZHOU, Mengjuan, BAI, Lulu, SHI, Jiadong, CHEN, Wenshuai, WANG, Ruzhu, TAN, Swee Ching. Integrating rooftop agriculture and atmospheric water harvesting for water-food production based on hygroscopic manganese complex. Advanced functional materials. 2024, vol. 34, iss. 38, [article no.] 2402839, str. 1-11, ilustr. ISSN 1616-301X.

DENG, Fangfang, POREDOŠ, Primož, YU, Jiaqi, YANG, Xinge, CHEN, Zhihui, WANG, Ruzhu. Waste heat-driven water generator with optimized multi-cycle strategy for high water yield. Applied energy. 2024, vol. 375, [art. no.] 124090, str. 1-8, ilustr. ISSN 0306-2619.

GALIČIČ, An, ROŽANEC, Jan, KUKEC, Andreja, MEDVED, Sašo, ERŽEN, Ivan. Assessment of perceived indoor air quality in the classrooms of Slovenian primary schools and its association with indoor air quality factors, for the design of public health interventions. Atmosphere. 2024, vol. 15, iss. 8, [art. no.] 995, str. 1-11, ilustr., tabele. ISSN 2073-4433.

DENG, Fangfang, POREDOŠ, Primož, YU, Jiaqi, CHEN, Zhihui, XIANG, Chengjie, YANG, Xinge, WANG, Ruzhu. Ultra-high-yield solar-driven modular atmospheric water harvester with improved heat management. Device. Oct. 2024, vol. 2, iss. 10, [art. no.] 100441, str. 1-11, ilustr. ISSN 2666-9986.

SHAO, Zhao, LV, Haotian, POREDOŠ, Primož, SU, Shiqiang, SUN, Ruikun, WANG, Hongbin, DU, Shuai, WANG, Ruzhu. Scaled solar-driven atmospheric water harvester with low-cost composite sorbent. Energy. Sep. 2024, vol. 302, [article no.] 131917, str. 1-11, ilustr. ISSN 0360-5442.

QUARANTA, Emanuele, ARKAR, Ciril, BRANQUINHO, Cristina, CRISTIANO, Elena, CRUZ DE CARVALHO, Ricardo, DOHNAL, Michal, GNECCO, Ilaria, et al. A daily time-step hydrological-energy-biomass model to estimate green roof performances across Europe to support planning and policies. Urban Forestry and Urban Greening. Mar. 2024, vol. 93, [article no.] 128211, str. 1-14, ilustr. ISSN 1618-8667.

DOCTORAL DISSERTATION

DOMJAN, Suzana. Povezava kazalnikov bivalnega okolja in delovanja pasivnih stavbnih sistemov z regresijskimi modeli toplotnega odziva stavbe : doktorsko delo. Mentor: Sašo Medved, commentor: Rok Fink

PROJECTS

Slovenian Research and Innovation Agency. Living Walls for Future Sustainable Buildings and Cities. Ciril Arkar. 1.10.2022 - 30.9.2025

Slovenian Research and Innovation Agency. New Approaches for Continuous Atmospheric Water Harvesting with Hydrogels through Radiative Energy Exchange with Space and Waste Heat Utilization. Primož Poredoš. 1.7.2024 – 30.6.2027

European Commission (MSCA COFUND EUTOPIA-SIF), and Development Fund of the Republic of Slovenia. Novel multidisciplinary approaches to efficient thermal management and lifespan extension of concentrated photovoltaics using continuous evaporative desalination powered by air-conditioning waste heat. Primož Poredoš. 1.12.2024 – 30.11.2026.

Slovenian Research and Innovation Agency. Green Urban Societies of the Future (I. phase). Primož Poredoš. 1.11.2024 – 31.10.2025.

AWARDS AND ACHIEVEMENTS

Best Novel Paper Award (37th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems), Rhodes, Greece. Title of the paper: Switchable multicyclic adsorption-based atmospheric water harvesting with solar and radiative sky cooling thermal concentration and heat pumps. Primož Poredoš, He Shan, Zhao Shao, Fangfang Deng, Ruzhu Wang, Eva Zavrl, Tej Žižak, Ciril Arkar.

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.

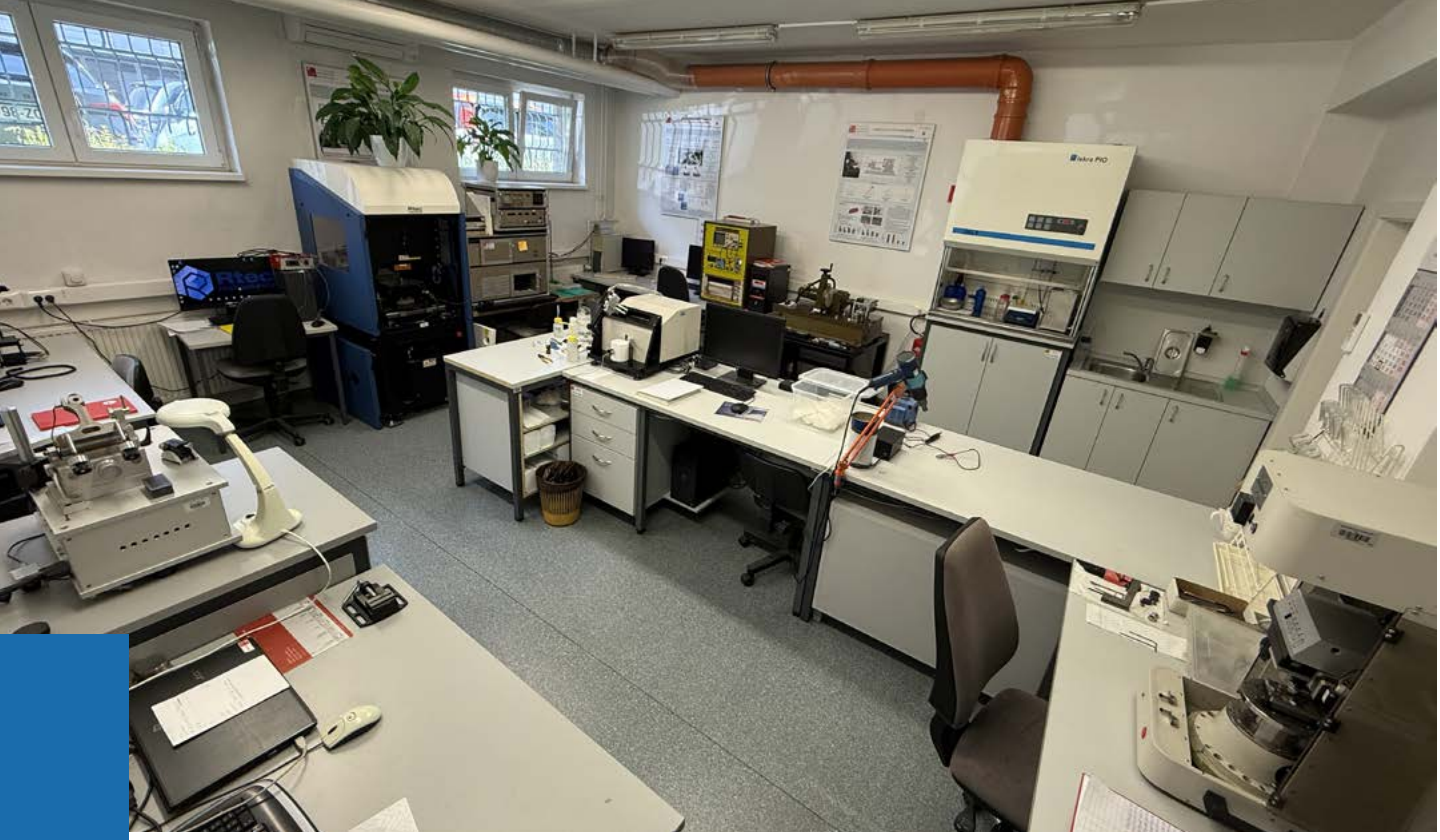


Photo: Željko Stevanić, IFP d.o.o.

Laboratory for tribology and interface nanotechnology TINT

RESEARCH AREAS

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

DEPARTMENT HEAD Prof. dr. Mitjan Kalin

DEPARTMENT MEMBERS Assist. Prof. dr. Marko Polajnar, Assist. Prof. dr. Janez Kogovšek, Assist. dr. Arshad Muhammad Shahid, Assist. dr. Blaž Žugelj, Assist. dr. Lucija Čoga, Assist. Urban Klanjšček, Assist. Sebastjan Matkovič, Assist. Siddiqui Muhammad Shoaib Naseem, Franc Kopač, Assist. PetraJan, Prashant Gangwani, Irfan Nadeem, Sr. Res. Assoc. Tomaž Požar, Jr. Res. dr. Osolnik Nejc, Assist. dr. Anastasia Sampdurova, Assist. Ajeeb Rayan, Assist. Mark Kuzman, Yunbo Hao, Jakob Živalič, Elton de Lima Savi, Parveen Kuma,r Sreed Sharma Kanakkillam, Neuma Pereira, Khodor Nasser, Talha Bin Yaqub, Alaaeddin Al Sheikh Omar, Ajay Pratap Singh Lodhi, Hongbo Ju, Chigulla Sateesh Kumar, Rahul Kumar, Abbas M. K. Al-Rjoub, Jožica Sterle

ORIGINAL SCIENTIFIC ARTICLES

NADEEM, Irfan, FINŠGAR, Matjaž, DRAŽIĆ, Goran, MALOK, Matjaž, MORINA, Ardian, KALIN, Mitjan. Robust and durable superlubricity enabled by carboxylated graphene quantum dots in lubricated steel contacts. Carbon. Jun. 2024, vol. 226, [article no.] 119226, str. 1-16, ilustr. ISSN 1873-3891.

ŠAPEK, Alen, KALIN, Mitjan, GODEC, Matjaž, DONIK, Črtomir, MARKOLI, Boštjan. Efect of feed rate during induction hardening on the hardening depth, microstructure, and wear properties of tool-grade steel work roll. Journal of materials science. Materials in engineering. 2024, vol. 19, str. 1-18.

PRAKASARAO, Chodisetti Surya, KALIN, Mitjan, KUMAR, B. V. Manoj. Influence of TiB2TiB2 and wear conditions on friction and wear behaviour of SiC ceramics in reciprocating sliding. Journal of the European ceramic society. [Print ed.]. May 2024, vol. 44, iss. 5, str. 2704-2719, ilustr. ISSN 0955-2219.

PRAKASARAO, Chodisetti Surya, NADEEM, Irfan, KALIN, Mitjan, KUMAR, B. Venkata Manoj. Development of electrical discharge machinable SiC-ZrN composites : unveiling high temperature sliding wear resistance. Journal of the European ceramic society. [Print ed.]. 2025, vol. 45, iss. 3, [art. no.] 117040, str. 1-12, ilustr. ISSN 0955-2219.

NADEEM, Irfan, AMBROŽIČ, Bojan, DRAŽIĆ, Goran, KOVAČ, Janez, CAVALEIRO, Albano, KALIN, Mitjan. Super-low friction and wear in steel contacts enabled by tribo-induced structural degradation of graphene quantum dots. Materials & design. Aug. 2024, vol. 244, [article no.] 113111, str. 1-14, ilustr. ISSN 0264-1275.

BLAZNIK, Mojca, FEI, Chenyi, KOŠMRL], Andrej, KALIN, Mitjan, STOPAR, David. Mechanical constraints to unbound expansion of B. subtilis on semi-solid surfaces. Microbiology spectrum. [Spletna izd.]. Jan. 2024, vol. 12, issue 1, str. 1-16, ilustr. ISSN 2165-0497.

FERREIRA, Pedro Martins, TRINDADE, Bruno, KALIN, Mitjan. Aging of polyetheretherketone (PEEK) and polyphthalamide (PPA) in polar and non-polar lubricant base oils. Polymer testing. Feb. 2024, vol. 131, [article no.] 108342, str. 1-12, ilustr. ISSN 1873-2348.

KNEISSL, Lucas M., JOFFE, Roberts, KALIN, Mitjan, EMAMI, Nazanin. Improving the tribological performance of POM through the incorporation of bio-based materials. Polymers. 2024, vol. 16, iss. 16, [art. no.] 2310, str. 1-22, ilustr. ISSN 2073-4360.

SHU, Ju, ESPEJO, Cayetano, KALIN, Mitjan, MORINA, Ardian. Tribological performance of fatty acid, acid/amine additive mixture and ionic liquid. Proceedings of the Institution of Mechanical Engineers. Part J, Journal of engineering tribology. 2024, vol. 238, iss. 10, str. 1320-1334, ilustr. ISSN 2041-305X.

ASTRATH, Nelson Guilherme Castelli, BERGMANN, E. V., ANGHINONI, Bruno, FLIZIKOWSKI, Gabriel Antonio Siqueira, NOVATSKI, A., JACINTO, C., POŽAR, Tomaž, KALIN, Mitjan, MALACARNE, Luis Carlos, BAESSO, Mauro L. Towards a comprehensive characterization of spatio temporal dependence of light induced electromagnetic forces in dielectric liquids. Scientific reports. Mar. 2024, [vol.] 14, [article no.] 5595, str. 1-13, ilustr. ISSN 2045-2322.

NASEER, Abqaat, EVARISTO, Manuel, OLIVEIRA, Joao, KALIN, Mitjan, CAVALEIRO, Albano. A sustainable deposition method for diamond-like nanocomposite coatings – insights into the evolution of atomic structure and properties. Surface & coatings technology. [Print ed.]. 2024, vol. 489, art. 131082, str. 1-9, ilustr. ISSN 0257-8972.

KALIN, Mitjan, JERINA, Jure, SHARMA, Sandan Kumar, KOVAČ, Janez. The effect of temperature on the transfer layer of an aluminium alloy on tool steel and the effect of CrN coating. Tribology : materials surfaces & interfaces. [Tiskana izd.]. Jan. 2024, vol. 18, iss. 1, str. 11-19, ilustr. ISSN 1751-5831.

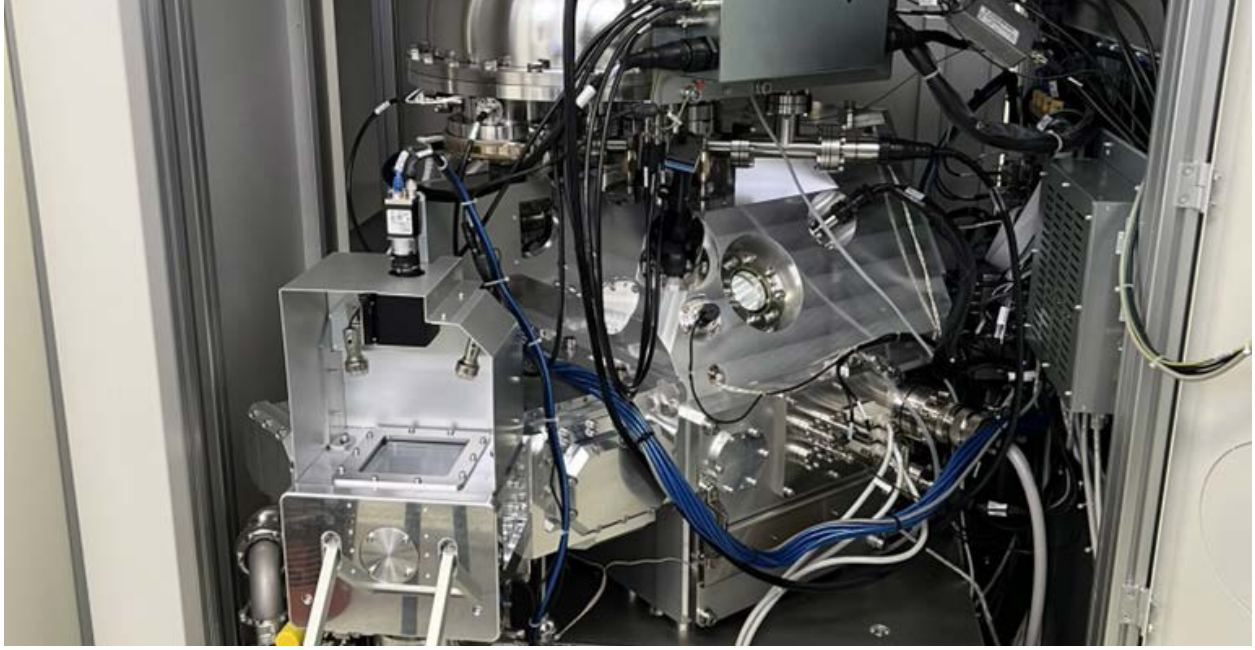
JAN, Petra, BRODNIK ŽUGEL], Blaž, KALIN, Mitjan. In-situ micro-asperity investigation of real contact area formation during sliding with the effects of roughness and normal load considered. Tribology international. Mar. 2024, vol. 191, str. 1-9, ilustr. ISSN 1879-2464.

SHU, Ju, ESPEJO, Cayetano, KALIN, Mitjan, MORINA, Ardian. Synergism between bio-based oleate ester and low-concentration ZDDP under reciprocating contacts. Tribology international. Apr. 2024, vol. 192, [article no.] 109252, str. 1-11, ilustr. ISSN 0301-679X.

MATKOVIČ, Sebastjan, KALIN, Mitjan. Effect of the coefficient of friction on gear-tooth root fatigue for both dry and lubricated running polymer gears. Tribology international. June 2024, vol. 194, art. 109525, str. 1-9, ilustr. ISSN 1879-2464.

GANGWANI, Prashant, KOVAČ, Janez, EMAMI, Nazanin, KALIN, Mitjan. Effect of multi-scale fillers on the tribological behavior of UHMWPE composites in water-lubricated contacts. Tribology international. Aug. 2024, vol. 196, [article no.] 109669, str. 1-18, ilustr. ISSN 0301-679X.

FERREIRA, Pedro Martins, ARNOUX, Quentin, CHARRIN, Catherine, TRINDADE, Bruno, KALIN, Mitjan. Lubrication of polyphthalamide (PPA) and polyetheretherketone (PEEK) with biodegradable synthetic esters : effects of base oil polarity, temperature and polymer aging. Tribology international. Dec. 2024, vol. 200, [article no.] 110157, str. 1-13, ilustr. ISSN 0301-679X.



PATENT

KITANOVSKI, Andrej, TOMC, Urban, KLINAR, Katja, VALENTINČIČ, Joško, MAJDIČ, Franc, SABOTIN, Izidor, MENCINGER, Jure. Method for heat transfer in the embedded structure of a heat regenerator and the design thereof : United States patent US 12,000,663 B2, 2024-06-04. Alexandria: United States Patent and Trademark Office, 2024.

KALIN, Mitjan. Method for treatment of a sliding surface on metallic machine part = Verfahren zur Behandlung einer Gleitfläche auf einem metallischen Maschinenteil = Procédé de traitement d'une surface de glissement sur une pièce de machine métallique : European patent specification EP 4 319 938 B1, 2024-06-05. [Munich]: European Patent Office, 2024.

DOCTORAL DISSERTATION

NADEEM, Irfan. Carbon-based quantum dots for green-lubrication technology : doctoral thesis. Mentors: Albano Cavaleiro and Mitjan Kalin

MATKOVIČ, Sebastjan. Effect of tribological properties on tooth root fatigue failure of polymer gears : doctoral thesis. Mentor: Mitjan Kalin

PROJECTS

Erasmus+ (Erasmus Mundus). TRIBOS+. Joint European Master on Tribology of Surfaces and Interfaces. Mitjan Kalin. 1.9.2018 – 31.8.2024

Slovenian Research and Innovation Agency. CODE-GM. Konstruiranje kontaktov na nano skali za visoko zmogljive, energetsko učinkovite in lahke komponente za zeleno mobilnost. Mitjan Kalin. 1.10.2022 – 30.9.2025

COMET K2. InTribology1. Tribology Intelligence – Customized Tribology for Industrial Innovation. Mitjan Kalin. 1.4.2020 – 31.3.2024

M-ERA.NET BilaTex – New generation of bioactive laser textured Ti/Hap implants. Marko Polajnar 1.5.2024-30.4.2027

HORIZON-MSCA-2022-DN-01- MSCA Doctoral Networks 2022 Patron - The Doctoral Network on Prognostics and heAlth management of nexT GeneRatiOn drivetraiNs. Marko Polajnar 1.2.2024 - 31.1.2028.

MSCA COFUND, HORIZON-MSCA-2021-COFUND-01 Surfaces and interfaces for sustainable green mobility- Mobility GT. Mitjan Kalin 1.7.2024-30.6.2029

AWARDS AND ACHIEVEMENTS

Prof. Dr. Mitjan Kalin Becomes a Regular Member of the European Academy of Sciences and Arts.

Prof. Dr. Mitjan Kalin was selected as an exceptional mentor 2024 by the University of Ljubljana.

Assist. Dr. Ifran Nadeem received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements.

Rector’s award for best innovations (Uni.Minds Festival) for 2024 (3rd place)

Photo: UL FME Archive

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. dr. Franc Majdič

DEPARTMENT MEMBERS Rok Jelovčan, Dev. Nejc Novak, Assist. dr. Ana Trajkovski, Assist. Jan Pustavrh, Jan Bartolj, Robert Horvat, Marko Polak, Jožica Sterle

ORIGINAL SCIENTIFIC ARTICLES

TRAJKOVSKI, Ana, BARTOL], Jan, LEVSTEK, Tomaž, GODEŠA, Tone, SEČNIK, Matej, HOČEVAR, Marko, MAJDIČ, Franc. Mechanical inter- and intra-row weed control for small-scale vegetable producers. Agriculture. 2024, vol. 14, iss. 9, [article no.] 1483, str. 1-14, ilustr. ISSN 2077-0472.

HLADNIK, Jurij, MAJDIČ, Franc, ČELIK, Anže, JERMAN, Boris. Dependence of the preload on the tightening torque for hydraulic plugs. Applied sciences. 2024, vol. 14, iss. 24, [art. no.] 11920, str. 1-12, ilustr. ISSN 2076-3417.

TRAJKOVSKI, Ana, MATKOVIČ, Sebastjan, NOVAK, Nejc, NADEEM, Irfan, KALIN, Mitjan, MAJDIČ, Franc. Glycerol aqueous solutions for the enhanced tribological behaviour of polymer composites sliding against steel. Tribology international. Apr. 2024, vol. 192, [article no.] 109173, str. 1-11, ilustr. ISSN 1879-2464.

TRAJKOVSKI, Ana, NOVAK, Nejc, PUSTAVRH, Jan, KALIN, Mitjan, MAJDIČ, Franc. Prednost uporabe inženirskih polimerov za trajnostne hidravlične komponente. Ventil : revija za fluidno tehniko in avtomatizacijo. avg. 2024, letn. 30, št. 4, str. 226-233, ilustr. ISSN 1318-7279.

PUGEL], Jan, TRAJKOVSKI, Ana, UREVC, Janez, MAJDIČ, Franc. Rekonstrukcija dvostopenjskega hidravličnega varnostnega ventila. Ventil : revija za fluidno tehniko in avtomatizacijo. dec. 2024, letn. 30, št. 6, str. 352-358, ilustr. ISSN 1318-7279.

SPAČAL, Žan, MAJDIČ, Franc, KALIN, Mitjan, TRAJKOVSKI, Ana. Trajnostni testi 3D natisnjenih vodno-hidravličnih proporcionalnih potnih ventilov. Ventil : revija za fluidno tehniko in avtomatizacijo. okt. 2024, letn. 30, št. 5, str. 296-304, ilustr. ISSN 1318-7279.

PATENT

KITANOVSKI, Andrej, TOMC, Urban, KLINAR, Katja, VALENTINČIČ, Joško, MAJDIČ, Franc, SABOTIN, Izidor, MENCINGER, Jure. Method for heat transfer in the embedded structure of a heat regenerator and the design thereof : United States patent US 12,000,663 B2, 2024-06-04. Alexandria: United States Patent and Trademark Office, 2024.

PROJECTS

Ministry of Agriculture, Forestry and Food - EIP. MOTIKA. Pospešeno okopavanje zelenjave. Franc Majdič. 19.5.2022 - 18.5.2025

Slovenian Research and Innovation Agency. SOFT LOGGING. Mehko robotski hidravlični vpenjalni sistem hlodovine . Franc Majdič. 1.10.2023 - 30.9.2026

Kolektor Etra d.o.o. Izdelava namenske hidravlične stiskalnice 10 ton po sistemu na ključ. Ana Trajkovski. 5.1.2024 - 5.9.2024

AWARDS AND ACHIEVEMENTS

Prof. Dr. Andrej Kitanovski (holder), Assist. Prof. Dr. Katja Klinar, Assoc. Prof. Dr. Franc Majdič, Dr. Jure Mencinger, Assist. Prof. Dr. Izidor Sabotin, Assist. Dr. Urban Tomc and Assoc. Prof. Dr. Joško Valentinčič have developed an innovative heat regenerator Hypereg, which the University of Ljubljana has ranked among its most notable research achievements for 2024.

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.

Photo: Željko Stevanić, IFP d.o.o

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. dr. Edvard Govekar

DEPARTMENT MEMBERS Assist. Prof. dr. Primož Potočnik, Assist. dr. Andrej Jeromen, Assist. Jaka Peternel, Assist. Jaka Simončič, Rehman Hammad Ur, Assist. Anish Nair, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

RAMKUMAR, P., NAIR, Anish, SIVASUBRAMANIAN, Mahadevan, BUDDHI, Dharam, PRAKASH, Chander. Effectiveness prediction of CuO nanofluid heat pipe system using fuzzy neuro approach. International Journal on Interactive Design and Manufacturing : IJIDEM. 2024, vol. 18, str. 2171-2182, ilustr. ISSN 1955-2505.

VIDERGAR, Ana, JEROMEN, Andrej, GOVEKAR, Edvard. Influence of the laser-beam intensity distribution on the performance of directed energy deposition of an axially fed metal powder. Journal of materials processing technology. Jun. 2024, vol. 327, [article no.] 118360, str. 1-16, ilustr. ISSN 1873-4774.

POTOČNIK, Primož, JEROMEN, Andrej, GOVEKAR, Edvard. Genetic algorithm-based optimization of the laser-beam path in additive manufacturing = Optimizacija poti laserskega žarka z genetskim algoritmom v proizvodnji z dodajalno tehnologijo. Materiali in tehnologije. [Tiskana izd.]. 2024, vol. 58, no. 2, str. 159-163, ilustr. ISSN 1580-2949.

POTOČNIK, Primož, JEROMEN, Andrej, GOVEKAR, Edvard. Genetic algorithm-based framework for optimization of laser beam path in additive manufacturing. Metals. 2024, vol. 14, iss. 4, [article no.] 410, str. 1-17, ilustr. ISSN 2075-4701.

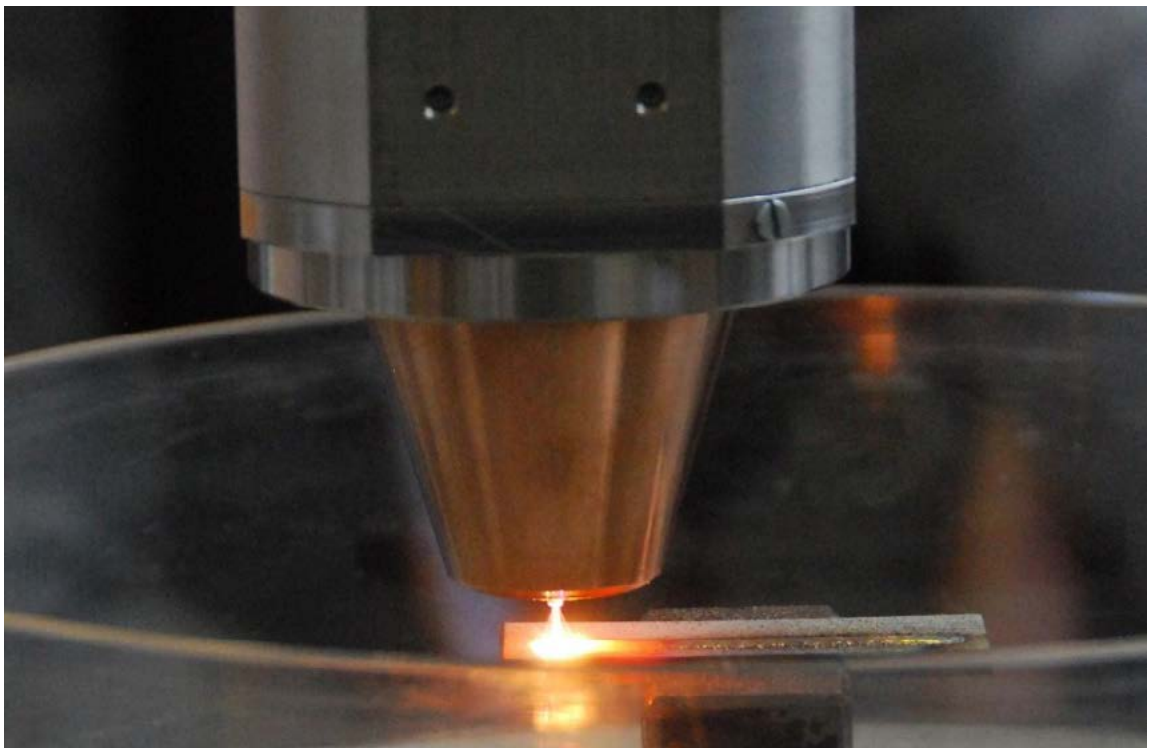


Photo: Željko Stevanić, IFP d.o.o

PROJECTS

Horizon Europe. SEAMAC. Strengthening the Excellence of Additive Manufacturing Capabilities. Edvard Govekar. 1.1.2023 - 31.12.2025

DOCTORAL DISSERTATION

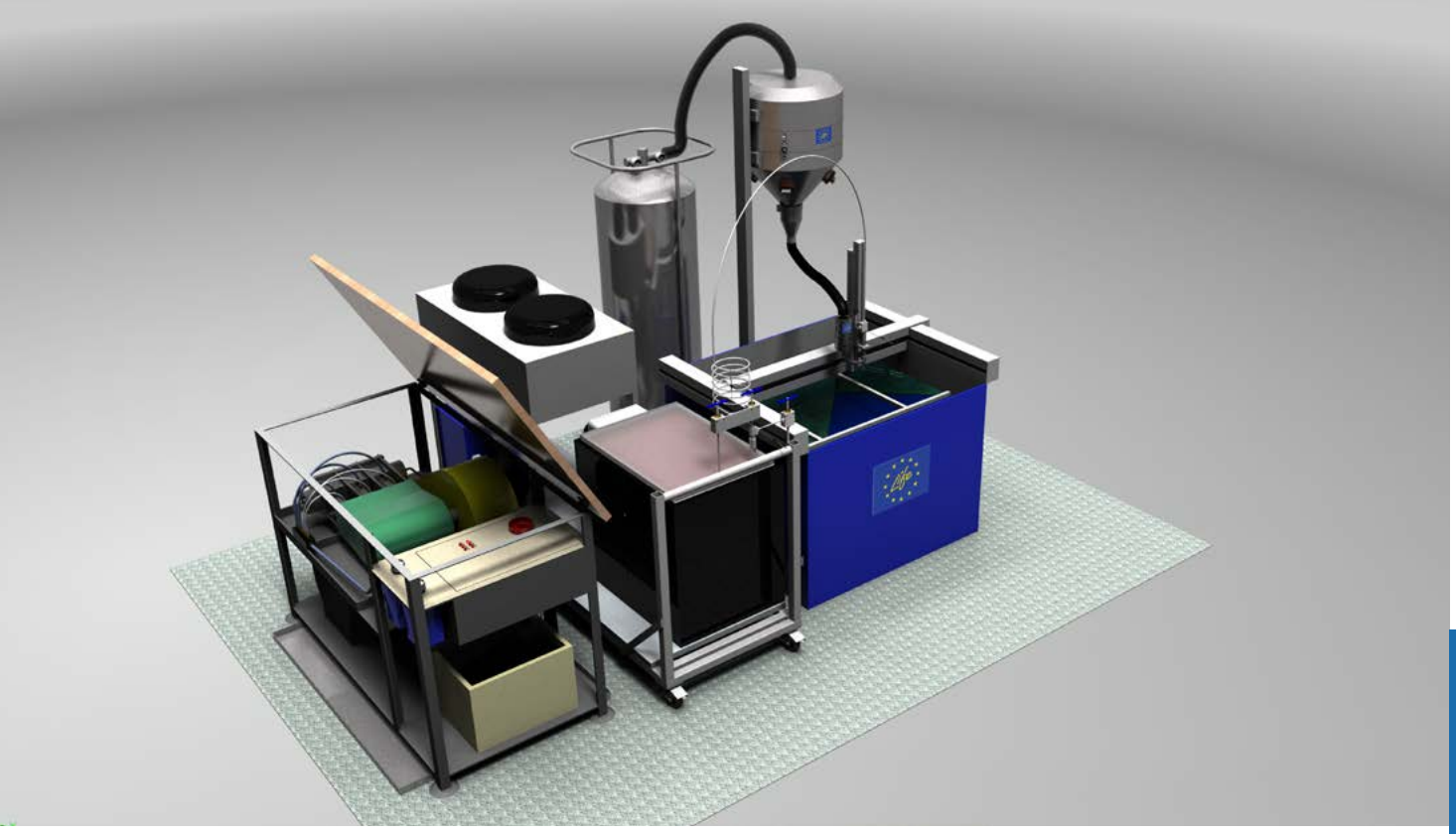
VIDERGAR, Ana. Izboljšave anularnega laserskega direktnega nanašanja kovinskega prahu : doktorsko delo. Mentor: Edvard Govekar

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. dr. Joško Valentinčič

DEPARTMENT MEMBERS Assist. Prof. dr. Andrej Lebar, Assist. Prof. dr. Henri Orbanić, Assist. Prof. dr. Izidor Sabotin, Assist. dr. Marko Jerman, Pavel Drešar, Edaklavan Koroth, Jithinraj, Tanja Plestenjak

ORIGINAL SCIENTIFIC ARTICLES

VALENTINČIČ, Joško, ZEIDLER, Henning, BÖTTGER, Toni, JERMAN, Marko. Influence of anode immersion speed on current and power in plasma electrolytic polishing. Micromachines. 2024, vol. 15, iss. 6, [article no.] 783, str. 1-13, ilustr. ISSN 2072-666X.

JERMAN, Marko, LEBAR, Andrej, SABOTIN, Izidor, VALENTINČIČ, Joško. Karakteristike obdelave aluminija 6061 z abrazivnim vodnim curkom z ozirom na standard SN 214001. Ventil : revija za fluidno tehniko in avtomatizacijo. jun. 2024, letn. 30, št. 3, str. 152-161, ilustr. ISSN 1318-7279.

PATENT

KITANOVSKI, Andrej, TOMC, Urban, KLINAR, Katja, VALENTINČIČ, Joško, MAJDIČ, Franc, SABOTIN, Izidor, MENCINGER, Jure. Method for heat transfer in the embedded structure of a heat regenerator and the design thereof : United States patent US 12,000,663 B2, 2024-06-04. Alexandria: United States Patent and Trademark Office, 2024.

PROJECTS

Horizon 2020 – ERA Chairs. COMPETE. Chair Of Micro Process Engineering and TEchnology. Joško Valentinčič. 1.9.2019 – 31.12.2024

Horizon Europe. SEAMAC. Strengthening the Excellence of Additive Manufacturing Capabilities. Joško Valentinčič. 1.1.2023 - 31.12.2025

Photo: Željko Stevanić, IFP d.o.o.

AWARDS AND ACHIEVEMENTS

Prof. Dr. Andrej Kitanovski (holder), Assist. Prof. Dr. Katja Klinar, Assoc. Prof. Dr. Franc Majdič, Dr. Jure Mencinger, Assist. Prof. Dr. Izidor Sabotin, Assist. Dr. Urban Tomc and Assoc. Prof. Dr. Joško Valentinčič have developed an innovative heat regenerator Hypereg, which the University of Ljubljana has ranked among its most notable research achievements for 2024.

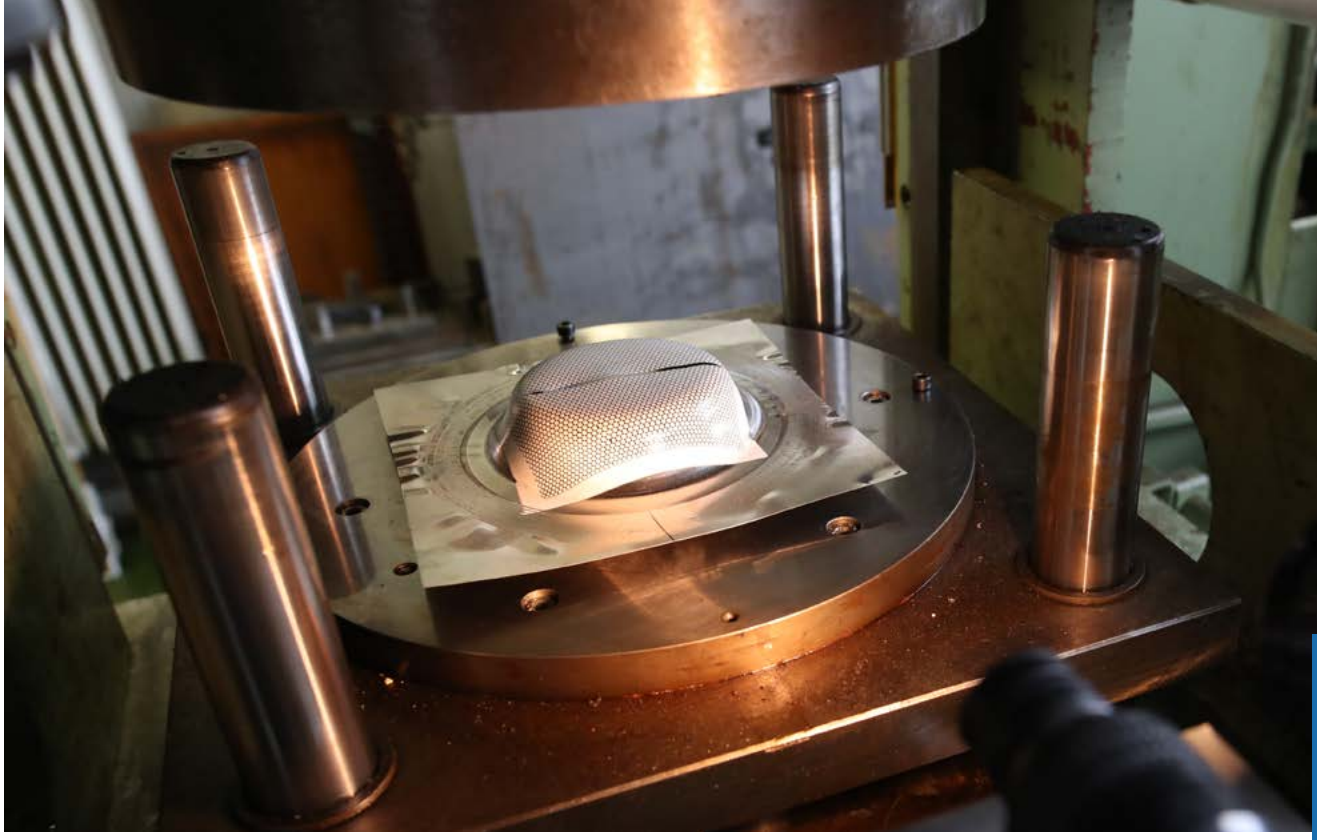


Photo: Željko Stevanić, IFP d.o.o.

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

ORIGINAL SCIENTIFIC ARTICLE

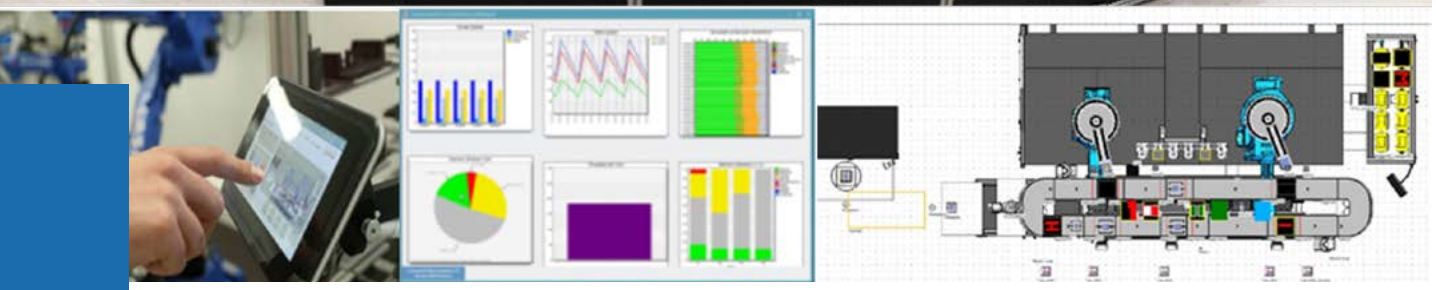
SEVŠEK, Luka, VILKOVSKÝ, S., MAJERNÍKOVÁ, J., PEPELNJAK, Tomaž. Predicting the deep drawing process of TRIP steel grades using multilayer perceptron artificial neural networks. Advances in production engineering & management. Mar. 2024, vol. 19, no. 1, str. 46–64, ilustr. ISSN 1854-6250.

SEVŠEK, Luka, PEPELNJAK, Tomaž. Optimisation of flexible forming processes using multilayer perceptron artificial neural networks and genetic algorithms : a generalised approach for advanced high-strength steels. Materials. 2024, vol. 17, iss. 22, [art. no.] 5459, str. 1-36, ilustr. ISSN 1996-1944.

PROJECTS

Dafra d.o.o. Izdelava digitalnega dvojčka mehatronskega štančnega orodja v okviru projekta »Pametno mehatronsko progresivno štančno orodje za izdelavo kombinacijskih setov tipskih izdelkov«. Tomaž Pepelnjak. 15.4.2024 - 14.4.2025

Pametne rešitve za procese TOVARNE PRIHODNOSTI



Laboratory for Handling, Assembly and Pneumatics
LASIM

RESEARCH AREAS

Industry 4.0 and 5.0 • Smart Factories • Digital Twins of Production and Logistics processes • IoT and 5G Technologies in Smart Factories • LPM-Lean Production Management Software • Production Logistics and Resources • Assembly and Handling • Smart Manual Workplaces and Ergonomics • Smart Hydraulic and Pneumatic Systems • Piezo engineering

DEPARTMENT HEAD Prof. dr. Niko Herakovič

DEPARTMENT MEMBERS Assist. Prof. dr. Marko Šimic, Assist. Prof. dr. Mihael Debevec, Assist. Prof. dr. Miha Pipan, Assist. dr. Hugo Zupan, Assist. dr. Matevž Resman, Edo Adrović, Assist. Denis Jankovič, Assist. Jure Filip Vuzem, Blaž Dobravec, Tanja Plestenjak

ORIGINAL SCIENTIFIC ARTICLE

JANKOVIČ, Denis, ŠIMIC, Marko, HERAKOVIČ, Niko. A data-driven simulation and Gaussian process regression model for hydraulic press condition diagnosis. Advanced engineering informatics. Jan. 2024, vol. 59, str. 1-22, ilustr. ISSN 1474-0346.

JANKOVIČ, Denis, ŠIMIC, Marko, HERAKOVIČ, Niko. A comparative study of machine learning regression models for production systems condition monitoring. Advances in production engineering & management. Mar. 2024, vol. 19, nr. 1, str. 78–92, ilustr. ISSN 1854-6250.

ZUPAN, Hugo, HERAKOVIČ, Niko, ŽEROVNIK, Janez. A robust heuristics for the online job shop scheduling problem. Algorithms. 2024, vol. 17, iss. 12, [art. no.] 568, 20 str., ilustr. ISSN 1999-4893.

ŠIMIC, Marko, HERAKOVIČ, Niko. Investigation of innovative high-response piezoelectric actuator used as smart actuator–sensor system. Applied sciences. 2024, vol. 14, iss. 18, art. 8523, str. 1-17, ilustr. ISSN 2076-3417.

JANKOVIČ, Denis, PIPAN, Miha, ŠIMIC, Marko, HERAKOVIČ, Niko. Polynomial regression-based predictive expert system for enhancing hydraulic press performance over a 5g network. Applied sciences. 2024, vol. 14, iss. 24, [art. no.] 12016, 24 str., ilustr. ISSN 2076-3417.

RESMAN, Matevž, HERAKOVIČ, Niko, DEBEVEC, Mihael. Integrating digital twin technology to achieve higher operational efficiency and sustainability in manufacturing systems. Systems. 2025, vol. 13, no. 3 , [article no.] 180, 25 str., ilustr. ISSN 2079-8954.

PIPAN, Miha, ŠIMIC, Marko, VONČINA, Leon, HERAKOVIČ, Niko. Use of 5G technology in manufacturing processes and systems. Ventil : revija za fluidno tehniko in avtomatizacijo. jun. 2024, letn. 30, št. 3, str. 144-150, ilustr. ISSN 1318-7279.

PROJECTS

Slovenian Research and Innovation Agency. Research on the reliability and efficiency of edge computing in a smart factory using 5G technologies. Niko Herakovič. 1.10.2022 -30.9.2025

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Marko Šimic. 1.1.2024 – 30.6.2026

Horizon Europe. STAGE. Sustainable Transition to the Agile and Green Enterprise. Marko Šimic. 1.6.2022 - 31.5.2025

Horizon Europe. INNO2MARE. Strengthening the capacity for excellence of Slovenian and Croatian innovation ecosystems to support the digital and green transitions of maritime regions. Marko Šimic. 1.1.2023 – 31.12.2026

DOCTORAL DISSERTATION

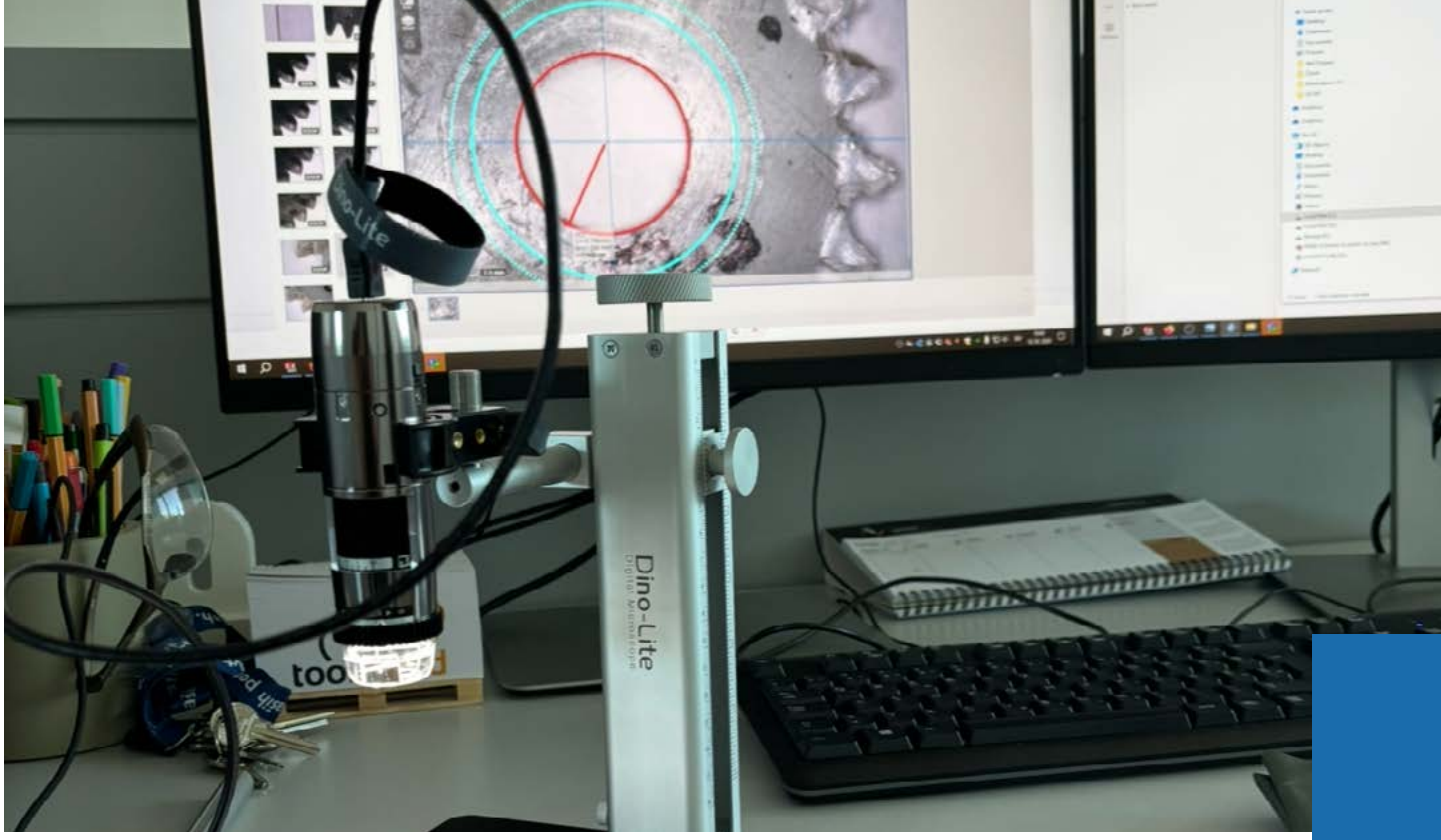
JANKOVIČ, Denis. Medsebojni vpliv karakteristik gradnikov in parametrov hidravlične stiskalnice z uporabo ekspertnega sistema : doktorsko delo. Mentor: Marko Šimic, commentor: Tomaž Pepelnjak

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 Assoc. Prof. dr. Nikola Vukašinović

DEPARTMENT MEMBERS Assoc. Prof. dr. Leon Kos, Assist. Prof. dr. Janez Benedičič, Asst. Prof. dr. Vanja Čok, Asst. Prof. dr. Ivan Demšar, Asst. Prof. dr. Tadej Kanduč, Assist. dr. Pavel Tomšič, Assist. dr. Mojškerc Bor, Assist. dr. Ivona Vasileska, Assist. dr. Jernej Kovačič, Assist. dr. Stefan Costea, Matjaž Šubelj, Assist. dr. Matic Brank, Aleš Durjava, Assist. Aljaž Žafran, Mateja Maffi, Gašper Omahen, Leon Bogdanovič, Prof. dr. Janez Povh, Assist, Assist. Prof. dr. Tadej Kanduč, Assist. Prof. dr. Aleksander Grm, Assist. dr. Uroš Urbas, Assist. Luka Samsa, Gregor Simič, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

GYERGYEK, Tomaž, KOS, Leon, COSTEA, Stefan, GYERGYEK, Miha, KOVAČIČ, Jernej. One-dimensional, multi-fluid model of the plasma wall transition. 1, Hot electrons. AIP advances. Apr. 2024, vol. 14, iss. 4, [aricle no.] 045201, 22 str., ilustr. ISSN 2158-3226.

JONES, Christopher R., OLTRA, Christian, GIACOMETTI, Alessio, ČOK, Vanja, POVH, Janez, LAMUT, Urša, MESKENS, Gaston, KENENS, Joke, GEYSMANS, Robbe, TURCANU, Catrinel, FERENCZ, Zoltan, ORLANDO, Maria Teresa, BUSTREO, Chiara. The clock is ticking : understanding the 'mixed feelings' about fusion energy in Europe. Energy research & social science. Jul. 2024, vol. 113, str. 1-17, ilustr. ISSN 2214-6296.

ČEŘOVSKÝ, Jaroslav, FICKER, Ondřej, MLYNÁŘ, Jan, TOMEŠOVÁ, Eva, CAVALIER, Jordan, WEINZETTL, Vladimir, JEŘÁB, Martin, ČALOUD, Jakub, FARNÍK, Michal, CASOLARI, Andrea, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., COMPASS team 1, MST1 team 2. Installation of the room temperature solid state pellet injector for investigation of runaway electrons at the COMPASS tokamak : COMPASS team 1, MST1 team. Fusion engineering and design. [Online ed.]. Apr. 2024, vol. 201.

BUSTREO, Chiara, AYED, N. Ben, BIBERACHER, M., BONGIOVÌ, G., ČOK, Vanja, POVH, Janez, et al. Socio economic perspectives on fusion power for a sustainable future energy system. Fusion engineering and design. [Print ed.]. Nov. 2024, vol. 208, [art. no.] 114679, str. 1-9, ilustr. ISSN 0920-3796.

YUAN, Chengxun, ZHOU, Chen, DEMIDOV, Mikhail V., GYERGYEK, Tomaž, KOVAČIČ, Jernej, KOEPKE, Mark E., KURLYANDSKAYA, Iya P., DEMIDOV, Vladimir I., COSTEA, Stefan, ZHOU, Zhongxiang. Correlation between fluctuating electron temperature and fluctuating space-potential challenges the probe determination of turbulent electric field spectrum. IEEE transactions on plasma science. [Print ed.]. Apr. 2024, vol. 52, no. 4, str. 1162-1167, ilustr. ISSN 0093-3813.

MEISTER, H., KUDASHEV, I., BRANK, Matic, INGESSON, L. C. Optimizing ITER bolometer cameras in view of internal reflections and crosstalk between channels. IEEE transactions on plasma science. [Print ed.]. 2024, vol. 52, no. 9, str. 1-7, ilustr. ISSN 0093-3813.

GYERGYEK, Tomaž, KOS, Leon, DIMITROVA, Miglena, COSTEA, Stefan, KOVAČIČ, Jernej. One-dimensional, multi-fluid model of the plasma-wall transition. 2, Negative ions. Journal of applied physics. [Online ed.]. 21. May 2024, vol. 135, iss. 19, [article no.] 193301, 20 str., ilustr. ISSN 1089-7550.

ZORKO, Damijan, WEI, Peitang, VUKAŠINOVIĆ, Nikola. The effect of gear-manufacturing quality on the mechanical and thermal responses of a polymer-gear pair. Journal of computational design and engineering. Feb. 2024, vol. 11, iss. 1, str. 195-211, ilustr. ISSN 2288-5048.

NAGY, Marianna E.-, ILLÉS, Tibor, POVH, Janez, VARGA, Anita, ŽEROVNIK, Janez. Sufficient matrices : properties, generating and testing. Journal of optimization theory and applications. 2024, vol. 202, str. 204-236, ilustr. ISSN 0022-3239.

LITAUDON, Xavier L, FANTZ, Ursel, VILLARI, Rosaria, KOS, Bor, KOS, Leon, KOTNIK, Domen, PERIC, Julijan, SNOJ, Luka, ŠTANCAR, Žiga, ŽOHAR, Andrej, et al. Eurofusion contributions to ITER nuclear operation. Nuclear fusion. 2024, vol. 64, [art. no.] 112006, str. 1-25, ilustr. ISSN 0029-5515.

KALIS, Joey, BIRKENMEIER, G., MANZ, P., EICH, T., GRIENER, Michael, GOTI, R., CAVEDON, Marco, GIL, Luís, FAITSCH, Michael, RADOVANOVIĆ, Lidija, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX-Upgrade Team, the Eurofusion MST1 Team. Experimental characterization of the quasi-coherent mode in EDA H-Mode and QCE scenarios at ASDEX Upgrade. Nuclear fusion. [Online ed.]. Jan. 2024, vol. 64, no. 1, [article no.] 016038, str. 1-16, ilustr. ISSN 1741-4326.

WIJKAMP, Tijs, HOPPE, Mathias, DECKER, Joan, DUVAL, Basil, PEREK, Artur, SHEIKH, Umar, CLASSEN, Ivo, JASPERS, Roger, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., TCV team. Resonant interaction between runaway electrons and the toroidal magnetic field ripple in TCV. Nuclear fusion. [Online ed.]. Jan. 2024, vol. 64, no. 1, [article no.] 016021, 10 str., ilustr. ISSN 1741-4326.

KRUTKIN, Oleg, KUMAR, Umesh, MAZZI, Samuele, BRUNNER, Stephan, CODA, Stefano, RIENÄCKER, S., VAN ROSSEM, M., GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., TCV Team. Validation of short-pulse reflectometry turbulence measurements with a synthetic diagnostic. Nuclear fusion. [Online ed.]. Feb. 2024, vol. 64, no. 2, [article no.] 026010, str. 1-19, ilustr. ISSN 1741-4326.

STAGNI, Adriano, VIANELLO, Nicola, AGOSTINI, Matteo, COLANDREA, Claudia, GORNO, Sophie, LABIT, Benoit, SHEIKH, Umar, SIMONS, Luke, SUN, Guangyu, TSUI, Cedric Kar-Wai, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., the TCV Team. The effect of plasma shaping on high density H-mode SOL profiles and fluctuations in TCV. Nuclear fusion. [Online ed.]. Feb. 2024, vol. 64, no. 2, [article no.] 026016, str. 1-16, ilustr. ISSN 1741-4326.

LEUTHOLD, Nils, SUTTROP, Wolfgang, PAZ-SOLDAN, Carlos, DUNNE, Mike, FISCHER, R., HINSON, Edward, KNOLKER, Matthias, LAGGNER, Florian M., LOGAN, Nikolas C., OSBORNE, T., COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX Upgrade Teama and the EUROfusion MST1 Team. Progress towards edge-localized mode suppression via magnetic perturbations in hydrogen plasmas. Nuclear fusion. [Online ed.]. Feb. 2024, vol. 64, no. 2, [article no.] 026017, str. 1-17, ilustr. ISSN 1741-4326.

CAZABONNE, Jean Arthur, CODA, Stefano, DECKER, Joan, KRUTKIN, Oleg, KUMAR, Umesh, SAVOYE-PEYSSON, Yves, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., the TCV Team. Impact of microwave beam scattering by density fluctuations on the electron–cyclotron power deposition profile in tokamaks. Nuclear fusion. [Online ed.]. Feb. 2024, vol. 64, no. 2, [article no.] 026019, str. 1-20, ilustr. ISSN 1741-4326.

RATYNSKAIA, S., PASCHALIDIS, K., KRIEGER, Karl, VIGNITCHOUK, Ladislas, TOLIAS, Panagiotis, BALDEN, Martin, FAITSCH, Michael, ROHDE, V., CORRE, Yann, PITTS, Richard, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX Upgrade Teama and the EUROfusion MST1 Team. Metallic melt transport across castellated tiles. Nuclear fusion. [Online ed.]. Mar. 2024, vol. 64, no. 3, [article no.] 036012, str. 1-9, ilustr. ISSN 1741-4326.

CARPITA, Massimo, FÉVRIER, Olivier, REIMERDES, Holger, THEILER, Christian, DUVAL, Basil, COLANDREA, Claudia, DURR-LEGOUPIL-NICOUD, Garance, GALASSI, Davide, GORNO, Sophie, HUETT, E., GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., The TCV Team. Parallel flows as a key component to interpret Super-X divertor experiments. Nuclear fusion. [Online ed.]. Apr. 2024, vol. 64, no. 4, [article no.] 046019, 18 str., ilustr. ISSN 1741-4326.

WANG, Yinghan, COLANDREA, Claudia, SALES DE OLIVEIRA, Diego, THEILER, Christian, REIMERDES, Holger, BODY, Thomas, GALASSI, Davide, MARTINELLI, L., LEE, Kenneth, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., the TCV Team. Validation of SOLPS-ITER simulations against the TCV-X21 reference case. Nuclear fusion. [Online ed.]. May 2024, vol. 64, no. 5, [article no.] 056040, 13 str., ilustr. ISSN 1741-4326.

GONZALEZ-MARTIN, Javier, GARCIA-MUNOZ, Manuel, GALDON-QUIROGA, Joaquin, TODO, Yasushi, DOMINGUEZ-PALACIOS, J., DUNNE, Mike, JANSEN VAN VUUREN, Anton, LIU, Yueqiang, SANCHIS, Lucía, SPONG, Donald, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX Upgrade Team and the MST1 Team. Active control of Alfvén eigenmodes by external magnetic perturbations with different spatial spectra. Nuclear fusion. [Online ed.]. Jul. 2024, vol. 64, no. 7, [article no.] 076022, 15 str., ilustr. ISSN 1741-4326.

MATVEEV, Dmitry, BAUMANN, Christoph, ROMAZANOV, Juri, BREZINŠEK, Sebastijan, KOVAČIČ, Jernej, COSTEA, Stefan, et al. An integral approach to plasma-wall interaction modelling for EU-DEMO. Nuclear fusion. [Online ed.]. Oct. 2024, vol. 64, no. 10, [article no.] 106043, str. 1-13, ilustr. ISSN 1741-4326.

HOELZL, Matthias, HUIJSMANS, G. T. A., ARTOLA, Francisco Javier, NARDON, Eric, BÉCOULET, Marina, SCHWARZ, N., KOS, Leon, et al. Non-linear MHD modelling of transients in tokamaks: a review of recent advances with the JOREK code. Nuclear fusion. [Online ed.]. 2024, vol. 64, no. 11, art. 112016, 1-14 str., ilustr. ISSN 1741-4326.

HAKOLA, Antti, BALDEN, Martin, BARUZZO, M., BISSON, R., BREZINŠEK, Sebastijan, DITTMAR, Timo, DOUAI, D., DUNNE, M., GARZOTTI, L., GROTH, M., ČUFAR, Aljaž, KOS, Bor, LENGAR, Igor, RADULOVIĆ, Vladimir, SNOJ, Luka, GYERGYEK, Tomaž, KOVAČIČ, Jernej, ŽOHAR, Andrej, et al., the EUROfusion Tokamak Exploitation Team, the ASDEX Upgrade Team and JET Contributors. Helium plasma operations on ASDEX Upgrade and JET in support of the non-nuclear phases of ITER. Nuclear fusion. 2024, vol. 64, no. 9, 16 str. ISSN 0029-5515.

WENDLER, Natalia, CHOMICZEWSKA, A., GROMELSKI, Wojciech, KOWALSKA-STRZECIWILK, Ewa, TELESCA, G., IVANOVA-STANIK, Irena, GARZOTTI, L., EESTER, D. Van, ZOTTA, V. K., FRIGIONE, D., COSTEA, Stefan, ČUFAR, Aljaž, GYERGYEK, Tomaž, KOVAČIČ, Jernej, LENGAR, Igor, RADULOVIĆ, Vladimir, SNOJ, Luka, ŽOHAR, Andrej, et al., JET Contributors , The Eurofusion Tokamak Exploitation Team. Impurity behaviour in JET high-current baseline scenario for deuterium, tritium and deuterium-tritium plasmas. Nuclear materials and energy. Dec. 2024, vol. 41, [article no.] 101743, 6 str., ilustr. ISSN 2352-1791.

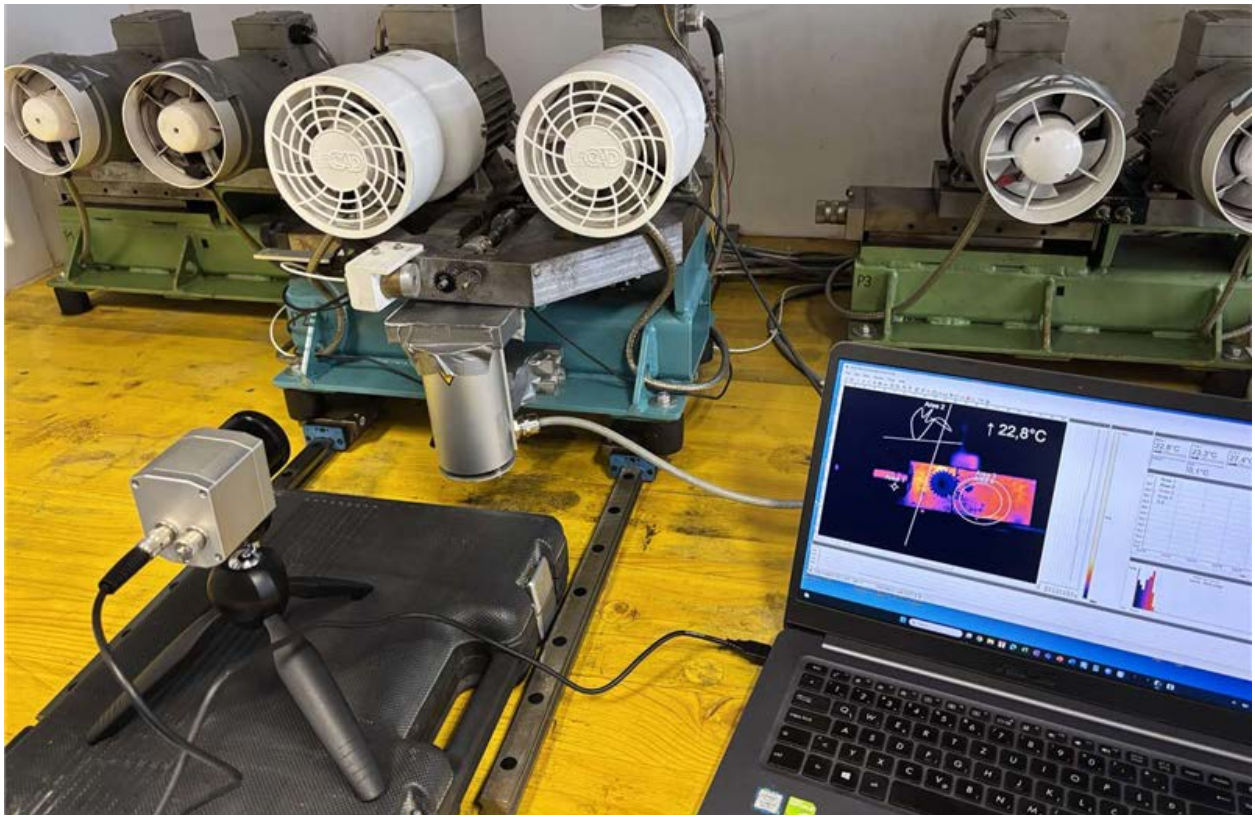


Photo: UL FME Archive

HUBER, A., SERGIENKO, G., GROTH, M., KEELING, D., WISCHMEIER, M., DOUAI, D., LERCHE, E., THUN, C.P. von, BREZINŠEK, Sebastijan, HUBER, V., COSTEA, Stefan, ČUFAR, Aljaž, GYERGYEK, Tomaž, KOVAČIČ, Jernej, LENGAR, Igor, RADULOVIĆ, Vladimir, SNOJ, Luka, ŽOHAR, Andrej, et al., JET contributors , the EUROfusion Tokamak Exploitation team. Investigation of H-mode density limit in mixed protium–deuterium plasmas at JET with ITER-like wall. Nuclear materials and energy. Dec. 2024, vol. 41, [article no.] 101806, 8 str., ilustr. ISSN 2352-1791.

CLOD PEDERSEN, Asbjørn, GIVSKOV SENSTIUS, Mads, NIELSEN, Anders Henry, RAGONA, Riccardo, THRYSØE, Alexander Simon, KUMAR, Umesh, CODA, Stefano, NIELSEN, Stefan Kragh, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., The TCV team. Cascades of parametric instabilities in the tokamak plasma edge during electron cyclotron resonance heating. Physical review letters. [Print ed.]. 29. mar. 2024, vol. 132, iss. 13, [article no.] 135101, str. 135101-1-135101-6, ilustr. ISSN 0031-9007.

SIEGLIN, Bernhard, MARASCHEK, M., GUDE, Anja, KLOSSEK, F., FELICI, F., BERNERT, Matthias, KUDLACEK, Ondrej, PAU, Alessandro, TREUTTERER, Wolfgang, COSTEA, Stefan, DRENIK, Aleksander, KOVAČIČ, Jernej, GYERGYEK, Tomaž, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX-Upgrade team, the Eurofusion MST1 team. Disruption avoidance and investigation of the H-Mode density limit in ASDEX Upgrade. Plasma physics and controlled fusion. [Online ed.]. Feb. 2024, vol. 66, no. 2, [article no.] 025004, str. 1-9, ilustr. ISSN 1361-6587.

SHEIKH, Umar, DECKER, Joan, HOPPE, Mathias, PEDRINI, Marta, SIEGLIN, Bernhard, SIMONS, Luke, CAZABONNE, Jean Arthur, ČALOUD, Jakub, ČEROVSKÝ, Jaroslav, CODA, Stefano, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX Upgrade Team, the TCV Team and the MST1 Team. Benign termination of runaway electron beams on ASDEX Upgrade and TCV. Plasma physics and controlled fusion. [Online ed.]. Mar. 2024, vol. 66, no. 3, [article no.] 035003, str. 1-8, ilustr. ISSN 1361-6587.

HACHMEISTER, Daniel, GARCIA SILVA, Carlos, SANTOS, Jorge Manuel, CONWAY, Garrard, GIL, Luís, SILVA, António Guilherme, STROTH, Ulrich, VICENTE, J., WOLFRUM, Elisabeth, MCDERMOTT, Rachael, COSTEA, Stefan, DRENIK, Aleksander, GYERGYEK, Tomaž, KOVAČIČ, Jernej, PANJAN, Matjaž, ZAPLOTNIK, Rok, et al., the ASDEX Upgrade Team4 and the EUROfusion MST1 Team. Influence of the magnetic configuration on the high-field side scrape-off layer at ASDEX Upgrade and the role of

the secondary separatrix. Plasma physics and controlled fusion. [Online ed.]. May 2024, vol. 66, no. 5, [article no.] 055016, 10 str., ilustr. ISSN 1361-6587.

DIMITROVA, Miglena, LÓPEZ-BRUNA, D., GUNN, James Paul, KOVAČIČ, Jernej, SVOBODA, V., STÖCKEL, Jan, et al. Plasma properties in the vicinity of the last closed flux surface in hydrogen and helium fusion plasma discharges. Plasma physics and controlled fusion. 2024, vol. 66, nr. 7, [article no.] 075022, str. 1-13, ilustr. ISSN 0741-3335.

CLOD PEDERSEN, Asbjørn, RAGONA, Riccardo, GIVSKOV SENSTIUS, Mads, JENSEN, Thomas, KUMAR, Umesh, CODA, Stefano, NIELSEN, Stefan Kragh, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., The TCV Team. Utilizing parametric instabilities to diagnose edge density fluctuations in TCV. Plasma physics and controlled fusion. [Online ed.]. Dec. 2024, vol. 66, no. 12, [article no.] 125001, 9 str., ilustr. ISSN 1361-6587.

BIWOLE, A Tema, PORTE, L, FASOLI, Ambrogio, FIGINI, Lorenzo, DECKER, Joan, HOPPE, Mathias, CAZABONNE, Jean Arthur, VOTTA, L, SIMONETTO, A, CODA, Stefano, GYERGYEK, Tomaž, KOVAČIČ, Jernej, et al., The TCV Team. Cross-calibration and first vertical ECE measurement of electron energy distribution in the TCV tokamak. Plasma physics and controlled fusion. [Online ed.]. Dec. 2024, vol. 66, no. 12, [article no.] 125010, 17 str., ilustr. ISSN 1361-6587.

MOJŠKERC, Bor, BERGANT, Zoran, ŠTURM, Roman, VUKAŠINOVIĆ, Nikola. Fatigue and wear performance of bioepoxy vacuum-infused and autoclave-cured E-glass fiber reinforced polymer composite gears in mesh with a steel pinion. Polymer testing. 2024, vol. 140, art. 108600, str. 1-11, ilustr. ISSN 0142-9418.

HRGA, Timotej, KLEP, Igor, POVH, Janez. Certifying optimality of Bell inequality violations: noncommutative polynomial optimization through semidefinite programming and local optimization. SIAM journal on optimization. Jun. 2024, vol. 34, iss. 2, str. 1341-1373, ilustr. ISSN 1052-6234.

PROJECTS

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

Horizon 2020. 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 2020. EUMaster4HPC. European Master for High Performance Computing. Janez Povh. 1.1.2022 - 31.12.2025

International Fusion Energy Organization. Associate for shaping optimization of Internal Components. Nikola Vukašinovič. 1.3.2020 - 29.2.2024

Horizon Europe. Plasma-PEPSC. Plasma Exascale-Performance Simulations CoE – Pushing flagship plasma simulations codes to tackle exascale-enabled Grand Challenges via performance optimisation and codesign. Leon Kos. 1.2.2023 – 31.12.2026

Slovenian Research and Innovation Agency. HEXAPIC. Delčna koda za heterogene računalniške arhitekture na ravni eksa. Leon Kos. 1.9.2024 - 31.8.2027

Horizon Europe. MAGRITTE. Recovering plasma-facing components temperatures in fusion devices from IR camera measurements. 1.9.2024 – 31.8.2026

Horizon Europe. EuroCC 2. National Competence Centres in the framework of EuroHPC Phase 2. Pavel Tomšič. 1.1.2023 – 31.12.2025

Horizon Europe. EXCELLERAT P2. European Centre of Excellence for Engineering Applications on HPC and associated technologies. Matic Brank. 1.1.2023 - 31.12.2026

Horizon Europe. EXCELLERAT P2. European Centre of Excellence for Engineering Applications on HPC and associated technologies. Matic Brank. 1.1.2023 - 31.12.2026

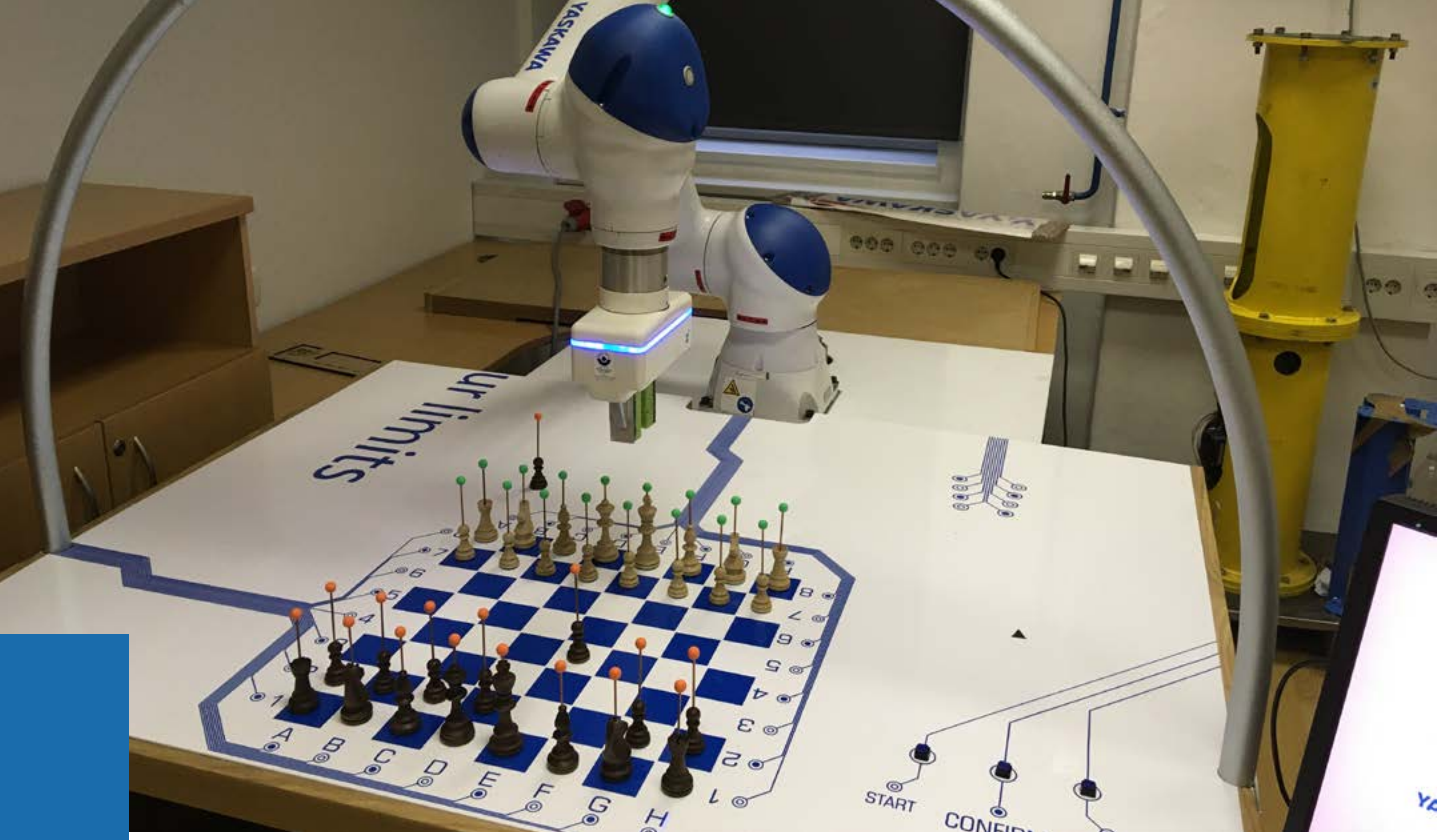


Photo: Željko Stevanić, IFP d.o.o.

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. dr. Boris Jerman
DEPARTMENT MEMBERS Assist. dr. Jurij Hladnik, MSc Franc Resman, Metod Čuk, Renata Piščanec

ORIGINAL SCIENTIFIC ARTICLES

HLADNIK, Jurij, MAJDIČ, Franc, ČELIK, Anže, JERMAN, Boris. Dependence of the preload on the tightening torque for hydraulic plugs. Applied sciences. 2024, vol. 14, iss. 24, [art. no.] 11920, str. 1-12, ilustr. ISSN 2076-3417.

EKREN, Banu Y., LERHER, Tone, KÜÇÜKYAŞAR, Melis, JERMAN, Boris. Cost and performance comparison of tier-captive SBS/RS with a novel AVS/RS/ML. International Journal of Production Research. 2024, no. 5, vol. 62, str. 1648–1662, ilustr. ISSN 0020-7543.

ČELIK, Anže, JERMAN, Boris, MAJDIČ, Franc. Simulacija mehanskega odziva nestandardnih čepov. Ventil : revija za fluidno tehniko in avtomatizacijo. apr. 2024, letn. 30, št. 2, str. 84-92, ilustr. ISSN 1318-7279.

ČELIK, Anže, JERMAN, Boris, MAJDIČ, Franc. Smernice za konstruiranje nestandardnih čepov. Ventil : revija za fluidno tehniko in avtomatizacijo. feb. 2024, letn. 30, št. 1, str. 28-[35], ilustr. ISSN 1318-7279.

PROJECTS

Tajfun Planina d.o.o. Raziskovalno delo na področju transportnih sredstev in transportnih sistemov s poudarkom na napredni dvigalni tehniki. Jurij Hladnik. 1.12.2023 - 30.11.2024

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.

Photo: Željko Stevanić, IFP d.o.o.

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. dr. Janko Slavič

DEPARTMENT MEMBERS Prof. dr. Miha Boltežar, Prof. dr. Gregor Čepon, Assist. Prof. dr. Martin Česnik, Assist. Prof. dr. Domen Ocepek, Assist. Prof. dr. Lorenzo Capponi, Assist. dr. Aleš Mihelič, Assist. dr. Tibor Barši Palmić, Assist. dr. Miha Kodrič, Assist. dr. Miha Pogačar, Assist. dr. Domen Gorjup, Assist. dr. Klemen Zaletelj, Assist. dr. Martin Furlan, Assist. Gašper Krivic, Assist. Tim Vrtač, Assist. Jure Korbar, Assist. Domen Kocbek, Assist. Jaša Šonc, Assist. Matic Mlinarič, Assist. Dubrovka Nikčević, Rozalija Petrovčič, Filip Marušič, Gregor Ševerkar, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

ČEPON, Gregor, OCEPEK, Domen, KODRIČ, Miha, DEMŠAR, Matija, BREGAR, Tomaž, BOLTEŽAR, Miha. Impact-pose estimation using ArUco markers in structural dynamics. Experimental techniques. [Print ed.]. 2024, vol. 48, str. 369–380, ilustr. ISSN 0732-8818.

KOŠIR, Tilen, ZUPAN, Marko, SLAVIČ, Janko. Self-aware active metamaterial cell 3D-printed in a single process. International journal of mechanical sciences. Nov. 2024, vol. 282, [art.] 109591, str. 1-12, ilustr. ISSN 1879-2162.

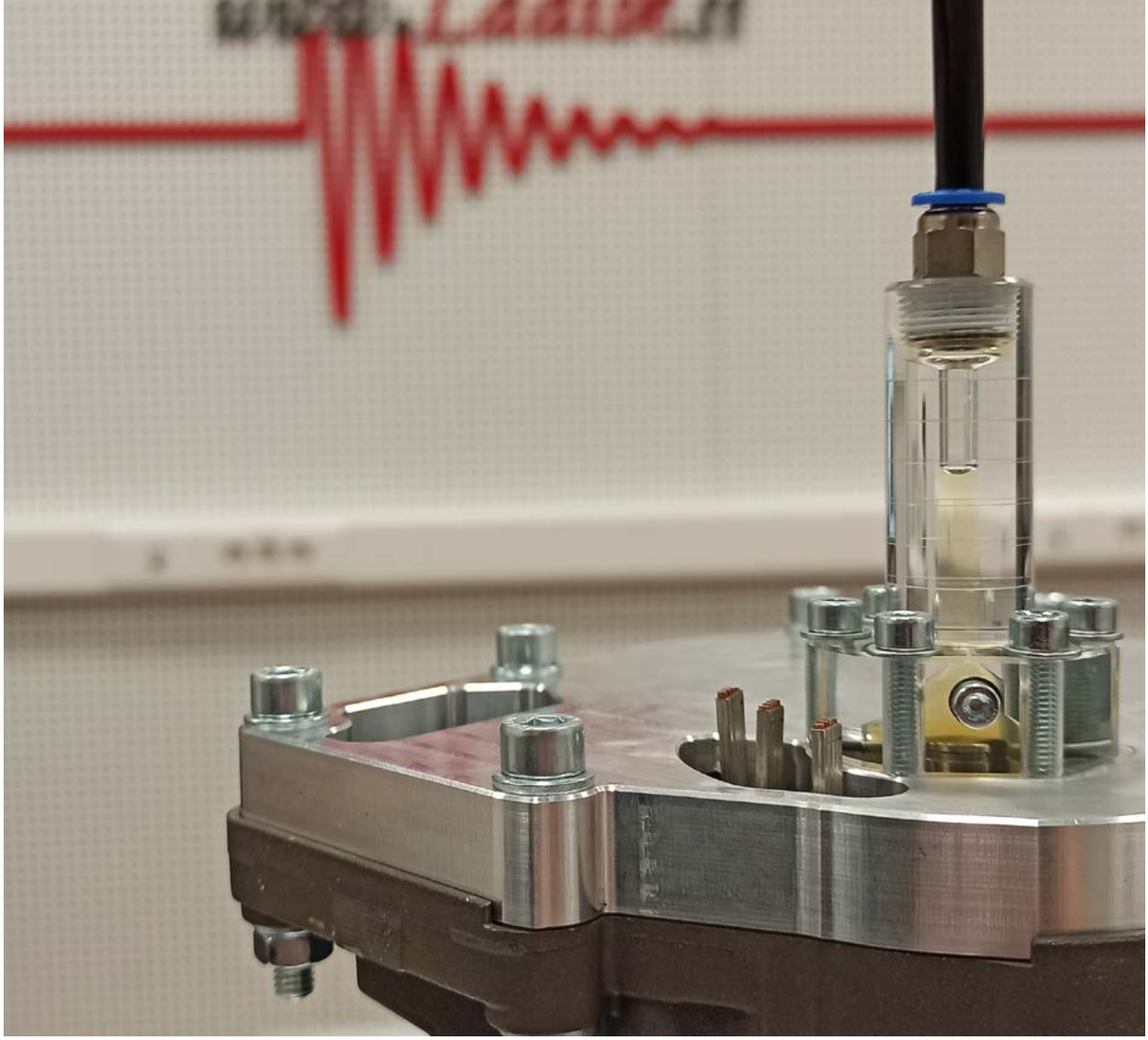


Photo: UL FME Archive

VRTAČ, Tim, OCEPEK, Domen, ČESNIK, Martin, ČEPON, Gregor, BOLTEŽAR, Miha. A hybrid modeling strategy for training data generation in machine learning-based structural health monitoring. Mechanical systems and signal processing. Jan. 2024, vol. 207, str. 1-20, ilustr. ISSN 1096-1216.

ČUFAR, Krištof, SLAVIČ, Janko, BOLTEŽAR, Miha. Mode-shape magnification in high-speed camera measurements. Mechanical systems and signal processing. May 2024, vol. 213, [article no.] 111336, str. 1-15, ilustr. ISSN 1096-1216.

OCEPEK, Domen, TRAINOTTI, Francesco, ČEPON, Gregor, RIXEN, Daniel J., BOLTEŽAR, Miha. On the experimental coupling with continuous interfaces using frequency based substructuring. Mechanical systems and signal processing. Aug. 2024, vol. 217, [article no.] 111517, str. 1-15, ilustr. ISSN 0888-3270.

ČESNIK, Martin, SLAVIČ, Janko. Frequency-dependent fatigue properties of additively manufactured PLA. Polymers. 2024, vol. 16, iss. 15, art. 2147, str. 1-13, ilustr. ISSN 2073-4360.

SALEHI, Niloufar, AMIR, Saman, ROCI, Malvina, SHOAIB-UL-HASAN, Sayyed, ASIF, Farazee, MIHELIČ, Aleš, SWEET, Susanne, RASHID, Amir. Towards circular manufacturing systems implementation : an integrated analysis framework for circular supply chains. Sustainable production and consumption. Nov. 2024, vol. 51, str. 169-198, ilustr. ISSN 2352-5509.

PATENTS

ČEPON, Gregor, KOREN, Uroš, STARC, Blaž, MIHELIČ, Aleš, POGOREVC, Robi, BOLTEŽAR, Miha, KATANEC, Jože. Washing machine belt pulley made of a plastic material : Unated States patent US11892070B2, 2024-02-06. Alexandria: Unated States Patent and Trademark Office, 2024.

DOCTORAL DISSERTATION

KOŠIR, Tilen. Dinamična piezoelektrična zaznavala, izdelana z metodo ciljnega nalaganja materiala v enem procesu : doktorsko delo. Mentor: Janko Slavič

OGRINEC, Primož. Impulzne obremenitve v vibracijskem utrujanju : doktorsko delo. Mentor: Janko Slavič, comentor: Miha Boltežar

PROJECTS

Slovenian Research and Innovation Agency. Single-Process Fused Filament Fabrication 3D- Printed Piezoelectric Sensor. Janko Slavič. 1.10.2021 – 30.9.2024

Mahle d.o.o. Modularni odprtokodni sistem za končno kontrolo izdelkov brez izmeta in za obdelavo velikih podatkov. Janko Slavič. 24.11.2023 - 30.6.2025

Domel d.o.o. Modularni odprtokodni sistem za končno kontrolo izdelkov brez izmeta in za obdelavo velikih podatkov. Janko Slavič. 10.11.2023 - 30.6.2025

Horizon Europe. DiCiM. Digitalised Value Management for Unlocking the potential of the Circular Manufacturing Systems with integrated digital solutions. Gregor Čepon. 1.1.2023 - 31.12.2026

Norway Grants. LEAP. Learning and demonstration alliance for designing and manufacturing sustainable industrial packaging from alternative lignocellulosic biomass. Gregor Čepon. 1.10.2022 - 30.4.2024

Gorenje d.o.o. Razvojno raziskovalno sodelovanje ter zakup kapacitet za numerične analize ter izvedbo meritev in preskusov. Gregor Čepon. 27.6.2021 - 27.6.2025

Iskra ISD d.o.o. Razvoj pametnega sistema iThor za detekcijo obrabe rezilnih orodij. Gregor Čepon. 2.11.2023 - 1.11.2024

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Janko Slavič. 1.1.2024 – 30.6.2026

Horizon Europe. ARTEMIDE. Outdoor space self-calibrating thermoelasticity-based fatigue damage identification. Janko Slavič. 1.10.2024 – 30.9.2026

European Space Agency ESA. DMSC. Feasibility study of using rigid-body dynamics model to reduce vibrations of miniature rotary integral Stirling cryocoolers. Tibor Barši Palmić. 19.6.2024 – 18.5.2025

Horizon Europe. CREDIT. Circularity and Remanufacturing-Enabling DIgital Twins. Gregor Čepon. 1.1.2024 – 31.12.2027

AWARDS AND ACHIEVEMENTS

Assist. Prof. Dr. Domen Ocepek and Assist. Jaša Šonc received an Award from the Faculty of Mechanical Engineering to colleagues under the age of 35 for outstanding research achievements.

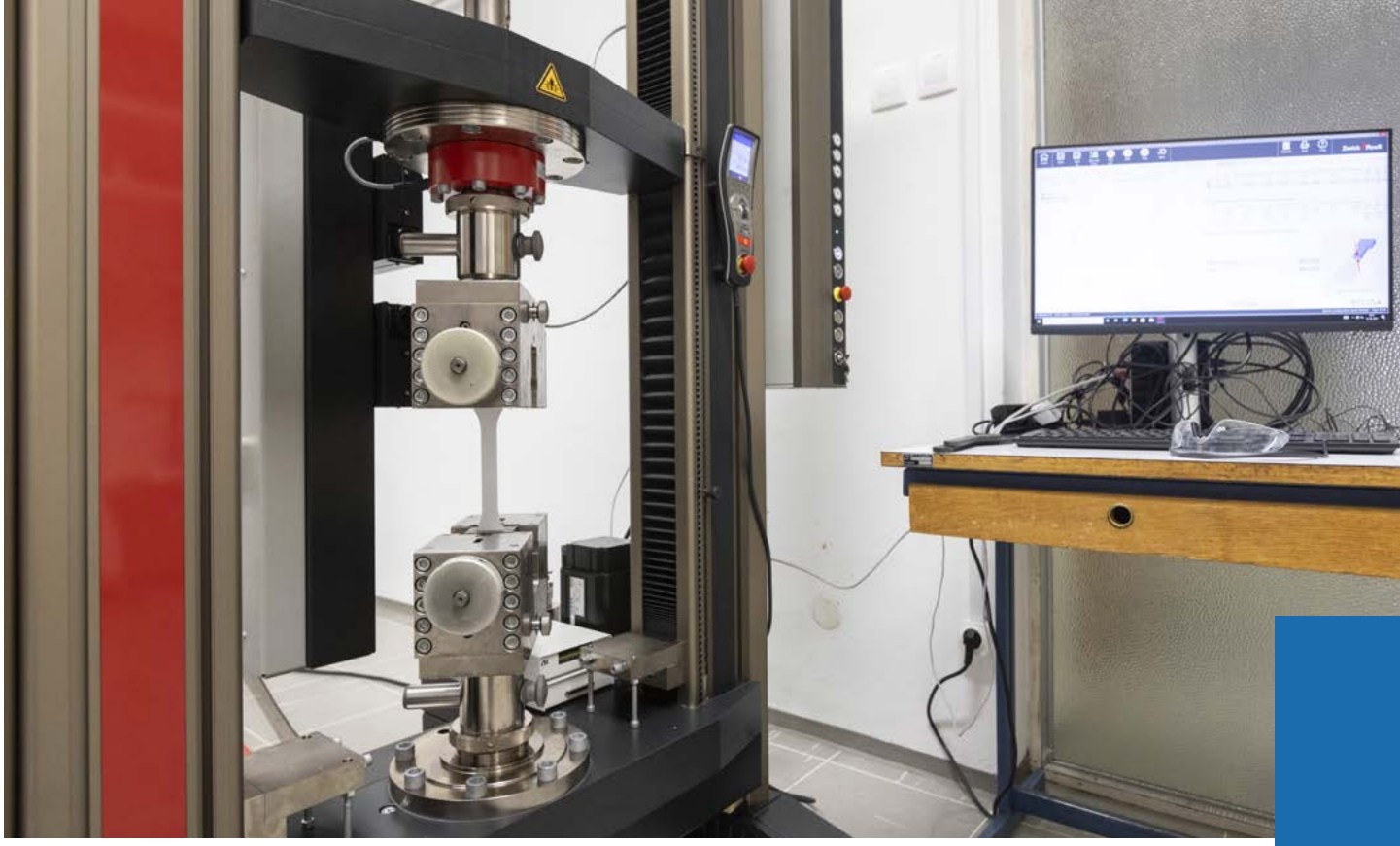


Photo: Željko Stevanić, IFP d.o.o

Laboratory for Non-Linear Mechanics LANEM

RESEARCH AREAS

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

DEPARTMENT HEAD Assist. Prof. dr. Miha Brojan

DEPARTMENT MEMBERS Assist. Jan Zavodnik, Assist. Jonas Trojer, Assist. Tomaž Brzin, Assist. Enej Istenič, Assist. dr. Damjan Lolić, Assist. David Rožamn, dr. Tomaž Videnič, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

ZAVODNIK, Jan, WANG, Yunbo, YAN, Wenzhong, BROJAN, Miha, JAWED, Mohammad Khalid. Soft kirigami composites for form-finding of fully flexible deployables. Advanced materials technologies. Jan. 2024, vol. 9, iss. 1, [article no.] 2300909, str. 1-9, ilustr. ISSN 2365-709X.

NEBOT-ANDRÉS, Laura, PETRUZZIELLO, Fabio, APREA, Ciro, LLOPIS, Rodrigo, ŽEROVNIK, Andrej, MAIORINO, Angelo, TUŠEK, Jaka. Parametric analysis of hybrid elastocaloric – CO2 cooling system. Applied thermal engineering. Sept. 2024, vol. 253, [article no.] 123843, str. 1-10, ilustr. ISSN 1359-4311.

AHČIN, Žiga, KITANOVSKI, Andrej, TUŠEK, Jaka. Latent thermal energy storage using solid-state phase transformation in caloric materials. Cell reports physical science. Sep. 2024, vol. 5, iss. 9, [article no.] 102175, str. 1-18, ilustr. ISSN 2666-3864.

BRZIN, Tomaž, BROJAN, Miha. Using a generative adversarial network for the inverse design of soft morphing composite beams. Engineering applications of artificial intelligence. [Print ed.]. 2024, vol. 133, pt. f, [art. no.] 108527, str. 1-9, ilustr. ISSN 0952-1976.

ZAVODNIK, Jan, BROJAN, Miha. Effects of nonlinearities and geometric imperfections on multistability and deformation localization in wrinkling films on planar substrates. Journal of the mechanics and physics of solids. Oct. 2024, vol. 191, [article no.] 105774, [19] str., ilustr. ISSN 1873-4782.

Photo: UL FME Archive

KUMPATI, Ramesh, SKARKA, Wojciech, SKARKA, Michał, BROJAN, Miha. Enhanced optimization of composite laminates : multi-objective genetic algorithms with improved ply-stacking sequences. Materials. Feb. 2024, vol. 17, iss. 4, [article no.] 887, str. 1-23, ilustr. ISSN 1996-1944.

PROJECTS

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Miha Brojan. 1.1.2024 – 30.6.2026.

Slovenian Research and Innovation Agency. Morphing soft kirigami composite system for the design of flexible deployables and soft-robots. Miha Brojan. 1.10.2022 – 30.9.2025.

Slovenian Research and Innovation Agency. COOL PRESS. Solid-state cooling with pressure: Developement of barocaloric cooling device. Jaka Tušek. 1.10.2022 - 30.9.2025.

Horizon Europe. FROSTBIT. First Regenerative sOlid-STate Barocaloric refrigerator. Jaka Tušek. 1.10.2024 - 30.9.2028.

Horizon Europe. SMACool. Shape Memory Alloy based elastocaloric Cooling system. Jaka Tušek. 1.10.2024 - 30.9.2027.

Slovenian Research and Innovation Agency. Advanced elastoclaoric regenerators. Jaka Tušek. 1.9.2024 - 31.8.2027.

Horizon Europe. E-CO-HEAT. Elastocaloric COoling and HEAT-pumping. Jaka Tušek. 1.9.2024 - 28.2.2026.

Photo: Željko Stevanić, IFP d.o.o

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

ORIGINAL SCIENTIFIC ARTICLES

CHEN, Bin, STARMAN, Bojan, HALILOVIČ, Miroslav, BERGLUND, Lars A., COPPIETERS, Sam. Finite element model updating for material model calibration : a review and guide to practice. Archives of computational methods in engineering. [Online ed.]. 2024, vol. , str. [1-78], ilustr. ISSN 1886-1784.

HALILOVIČ, Miroslav, STARMAN, Bojan, COPPIETERS, Sam. Computationally efficient stress reconstruction from full-field strain measurements. Computational mechanics. 2024, vol. 74, str. 849–872, ilustr. ISSN 1432-0924.

OBID, Štefan, STARMAN, Bojan, UREVC, Janez, HALILOVIČ, Miroslav. Extraction of uniaxial stress–strain curve from bending test using DIC measurements. European journal of mechanics - A/Solids. Jul.–Aug. 2024, vol. 106, [article no.] 105346, str. 1-15, ilustr. ISSN 0997-7538.

SHANKHWAR, Vishwajeet, UREVC, Janez, STEUBER, Bianca, SCHIMD-ZALAUDEK, Karin, SALON, Adam, HAWLICZEK, Anna, BERGAUER, Andrej, AL]ASMI, Khawla, ABDI, Asrar, NASER, Asmaa, et al. Effects of menstrual cycle on hemodynamic and autonomic responses to central hypovolemia. Frontiers in cardiovascular medicine. Feb. 2024, vol. 11, [article no.] 1290703, str. 1-9, ilustr. ISSN 2297-055X.

MAČEK, Andraž, STARMAN, Bojan, COPPIETERS, Sam, UREVC, Janez, HALILOVIČ, Miroslav. Confidence intervals of inversely identified material model parameters : a novel two-stage error propagation model based on stereo DIC system uncertainty. Optics and lasers in engineering. [Print ed.]. Mar. 2024, vol. 174, [article no.] 107958, str. 1-11, ilustr. ISSN 0143-8166.

KOC, Pino. On experimental determination of poisson's ratio for rock-like materials using digital image correlation. Strojniški vestnik. 2024, vol. 70, no. 5/6, str. 211-222, ilustr. ISSN 0039-2480.

PROJECTS

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

NEK d.o.o. Izdelava neodvisnih analiz in strokovnega mnenja na poročila vezano na puščanje SI-53 cevovoda. Miroslav Halilovič. 19.12.2023 - 30.6.2024

Hella Saturnus. Vedenje in simulacija ortotropnih materialov in struktur. Miroslav Halilovič. 17.11.2023 - 30.9.2024

Hella Saturnus. Vedenje in simulacija reodiktičnih materialov s kompleksno termo-mehansko zgodovino. Miroslav Halilovič. 17.11.2023 - 30.9.2024

Gorenje d.o.o. Karakterizacija emajlirane pločevine. Miroslav Halilovič. 1.10.2023 - 15.5.2024

NEK d.o.o. Študija vpliva izvedenih modifikacij na napetostne razmere v linijah SI-53/Si-52. Bojan Starman. 7.11.2023 - 31.3.2024

European Space Agency ESA. JVPdevice. Device for non-invasive determination of jugular vein pressure and the risk of thrombosis. Janez Urevc. 2.10.2023 - 31.12.2024

Photo: Željko Stevanić, IFP d.o.o

Laboratory for aeronautics AEROL

RESEARCH AREAS

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

DEPARTMENT HEAD Prof. dr. Franci Pušavec
DEPARTMENT MEMBERS Assist. dr. Igor Petrović, Assist. Peter Pipp, Branimir Filovski, Teja Pirnat

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.

Photo: Željko Stevanić, IFP d.o.o

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. dr. Lidija Slemenik Perše,

DEPARTMENT MEMBERS Res. assoc. dr. Mohor Mihelčič, Assist. Prof. dr. Alen Oseli, Assist. dr. Urška Gradišar Centa, Assist. dr. Sadaf Mahrukh, Matic Šobak, Jr. Res Serafimoski Stefan, Jr. Res urban Kotnik, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

GRADIŠAR CENTA, Urška, POGAČNIK KRAJNC, Anja, SLEMENIK PERŠE, Lidija, ŠOBAK, Matic, MIHELČIČ, Mohor. The addition of MoO [sub] 3 or SiO [sub] 2 nano-/microfillers thermally stabilized and mechanically reinforce the PVDF-HFP/PVP polymer composite thin films. Coatings. 2024, vol. 14, iss. 12, [art. no.] 1603, 12 str., ilustr. ISSN 2079-6412.

CAPITANI, Giancarlo, VERGANI, Fabrizio, CONCONI, Roberto, MRVAR, Primož, BOMBAČ, David, SLEMENIK PERŠE, Lidija, OSELI, Alen, BIZJAN, Benjamin. Recycling thermally detoxified asbestos-cement in stone-wool : an end-less-life material!. Construction & building materials. [Print ed.]. Aug. 2024, vol. 440, [article no.] 137351, str. 1-10, ilustr. ISSN 0950-0618.

KREFT, Klemen, LAVRIČ, Zoran, GRADIŠAR CENTA, Urška, MIHELČIČ, Mohor, SLEMENIK PERŠE, Lidija, DREU, Rok. Correlating mechanical and rheological filament properties to processability and quality of 3D printed tablets using multiple linear regression. International journal of pharmaceutics. [Print ed.]. 2024, vol. 651, 14 str., ilustr. ISSN 0378-5173.

ALI, Syed Ahmed, ALI, Yumna, SADAF, Mahrukh. Surface modification of Zr implants through Micro-Arc Oxidation and in-vitro evaluation of physiological reaction – a systematic review. Journal of dental implant research. Dec. 2024, vol. 43, no. 4, str. 67-76, ilustr. ISSN 2671-941X.

SADAF, Mahrukh, CANO, Santiago, BRAGAGLIA, Mario, SCHUSCHNIGG, Stephan, KUKLA, Christian, HOLZER, Clemens, VÁLY, Lilla, KITZMANTEL, Michael, NANNI, Francesca, GONZALEZ-GUTIERREZ, Joamin. Comparative analysis of binder systems in copper feedstocks for metal extrusion additive manufacturing and metal injection moulding. Journal of Materials Research and Technology. 2024, vol. 29, str. 4433-4444, ilustr. ISSN 2238-7854.

ALI, Syed Ahmed, ALI, Yumna, SADAF, Mahrukh. Effect of strontium-doped titanium implants on the osseointegration – a systematic review. Periodontal and implant research. [Online ed.]. 2024, vol. 8, no. 9, str. 1-16, ilustr. ISSN 2948-2453.

OSELI, Alen, MIHELČIČ, Mohor, ŠOBAK, Matic, SLEMENIK PERŠE, Lidija. Nonlinear time-dependent behavior of rheodictic polymers : a theoretical and experimental investigation. Polymer testing. Aug. 2024, vol. 137 , [article no.] 108535, str. 1-11, ilustr. ISSN 1873-2348.

GRADIŠAR CENTA, Urška, OSELI, Alen, MIHELČIČ, Mohor, KRAL], Aleš, ŽNIDARŠIČ, Matjaž, HALILOVIČ, Miroslav, SLEMENIK PERŠE, Lidija. Long-term viscoelastic behavior of polyisobutylene sealants before and after thermal stabilization. Polymers. 2024, vol. 16, no. 1, [article no. 22], str. 1-14, ilustr. ISSN 2073-4360. PUBMED); tip dela je verificiral OSICN točke: 44.35, št. avtorjev: 3/7

DERMOL, Špela, BORIN, Bojan, GREGOR-SVETEC, Diana, SLEMENIK PERŠE, Lidija, LAVRIČ, Gregor. The development of a bacterial nanocellulose/cationic starch hydrogel for the production of sustainable 3D-printed packaging foils. Polymers. 2024, vol. 16, iss. 11, [article no.] 1527, str. 1-23, ilustr. ISSN 2073-4360.

MIHELČIČ, Mohor, OSELI, Alen, ROJAC, Tadej, SLEMENIK PERŠE, Lidija. Surface modification of copper-based flakes for conductive polymer composites. Polymers. Jun. 2024, vol. 16, iss. 12, [art.] 1620, str. 1-14, ilustr. ISSN 2073-4360.

PROJECTS

Slovenian Research and Innovation Agency. Sustainable polymer materials and technologies. Lidija Slemenik Perše. 1.1.2020 - 31.12.2025

Slovenian Research and Innovation Agency. Sustainable use of polymers in home appliances - Prediction of long-term viscoelastic behavior. Lidija Slemenik Perše. 1.10.2021 - 30.9.2024

Hella Saturnus. Vedenje in simulacija ortotropnih materialov in struktur. Lidija Slemenik Perše. 17.11.2023 - 30.9.2024

Hella Saturnus. Vedenje in simulacija reodiktičnih materialov s kompleksno termo- mehansko zgodovino. Lidija Slemenik Perše. 17.11.2023 - 30.9.2024

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.

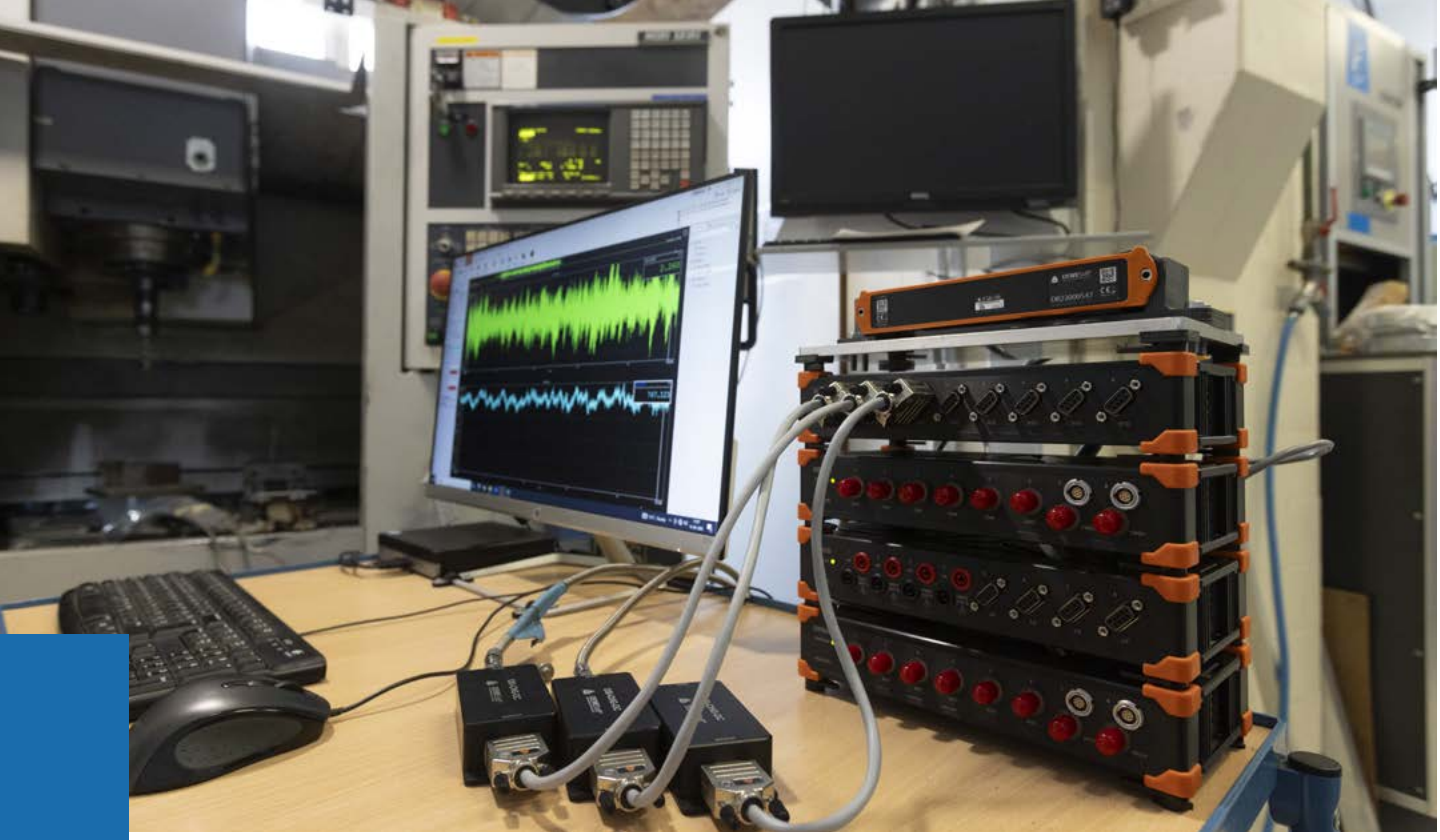


Photo: Željko Stevanić, IFP d.o.o

Laboratory for Machining 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. dr. Franci Pušavec

DEPARTMENT MEMBERS Assoc. Prof. dr. Peter Krajnik, Res. Assoc. dr. Radovan Dražumerič, Assist. dr. Awais Ikram, Assist. dr. Damir Grguraš, Assist. Jaka Dugar, Assist. Matjaž Kern, Vinko Rotar, Assist. Luka Sterle, Assist. Deepa Kareepadath Santhos, Rodriguez Bogajo Iñigo, Assist. Luka Kastelic, Assist. Vid Gostiša, Stella Cavalleri

ORIGINAL SCIENTIFIC ARTICLES

RODRIGUEZ, Iñigo, ARRAZOLA, Pedro J., PUŠAVEC, Franci. The impact of airborne emissions from coolants and lubricants on machining costs. CIRP annals. 2024, vol. 73, iss. 1, str. 77-80, ilustr. ISSN 0007-8506.

HOIER, Philipp, KAREEPADATH SANTHOSH, Deepa, HRYHA, Eduard, KRAJNIK, Peter. An investigation into the grindability of additively manufactured 42CrMo4 steel. CIRP annals. 2024, vol. 73, iss. 1, str. 257-260, ilustr. ISSN 0007-8506

KRAJNIK, Peter, WEGENER, Konrad, BERGS, Thomas, SHIH, Albert J. Advances in modeling of fixed-abrasive processes. CIRP annals. 2024, vol. 73, iss. 2, str. 589-614, ilustr. ISSN 0007-8506.

RODRIGUEZ, Iñigo, ARRAZOLA, P. J., CUESTA, Mikel, PUŠAVEC, Franci. Hole quality improvement in CFRP/Ti6Al4V stacks using optimised flow rates for LCO2LCO2 and MQL sustainable cooling/ lubrication. Composite structures. Feb. 2024, vol. 329, [article no.] 117687, str. 1-17, ilustr. ISSN 1879-1085.

HRIBERŠEK, Matija, KULOVEC, Simon, IKRAM, Awais, KERN, Matjaž, KASTELIC, Luka, PUŠAVEC, Franci. Technological optimization and fatigue evaluation of carbon reinforced polyamide 3D printed gears. Heliyon. July 2024, vol. 10, iss. 13, [article no.] e34037, str. 1-16, ilustr. ISSN 2405-8440.

KAREEPADATH SANTHOSH, Deepa, HOIER, Philipp, PUŠAVEC, Franci, KRAJNIK, Peter. Effect of lubricated liquid carbon dioxide (LCO2 + MQL) on grinding of AISI 4140 steel. Journal of manufacturing and materials processing. [Online ed.]. 2024, vol. 8, no. 5, art. 230, str. 1-16, ilustr. ISSN 2504-4494.

PROJECTS

Slovenian Research and Innovation Agency. Research and development of innovative manufacturing technologies for hydrogen fuel cell production for green mobility. Damir Grguraš. 01.10.2022 - 30.9.2024

Erasmus+ (Erasmus Mundus). META4.0. Manufacturing 4.0 by intElligent and susTAinable technologies. Franci Pušavec. 1.11.2022 - 31.12.2028

Slovenian Research and Innovation Agency. Research on near dry cryogenic machining for transition to cleaner and waste free production in mass automotive industry. Franci Pušavec. 1.10.2023 - 30.9.2026

Norway Grant. Combined learning model for vocational education in the field of mechanical engineering and development of competencies of students and teachers for digital education. Franci Pušavec. 1.6.2022 – 30.4.2024

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Franci Pušavec. 1.1.2024 – 30.6.2026

Slovenian Research and Innovation Agency. Basic Investigation of the Applicability of Artificial Intelligence Based Predictive Models to Improve the Quality of Production with Advanced Machining Processes. Franci Pušavec. 1.3.2024 - 28.2.2027

DOCTORAL DISSERTATION

KERN, Matjaž. Karakterizacija in napovedovanje učinka pulzirajočega visokotlačnega dovoda hladilno mazalne tekočine v proces struženja : doktorsko delo. Mentor: Franci Pušavec

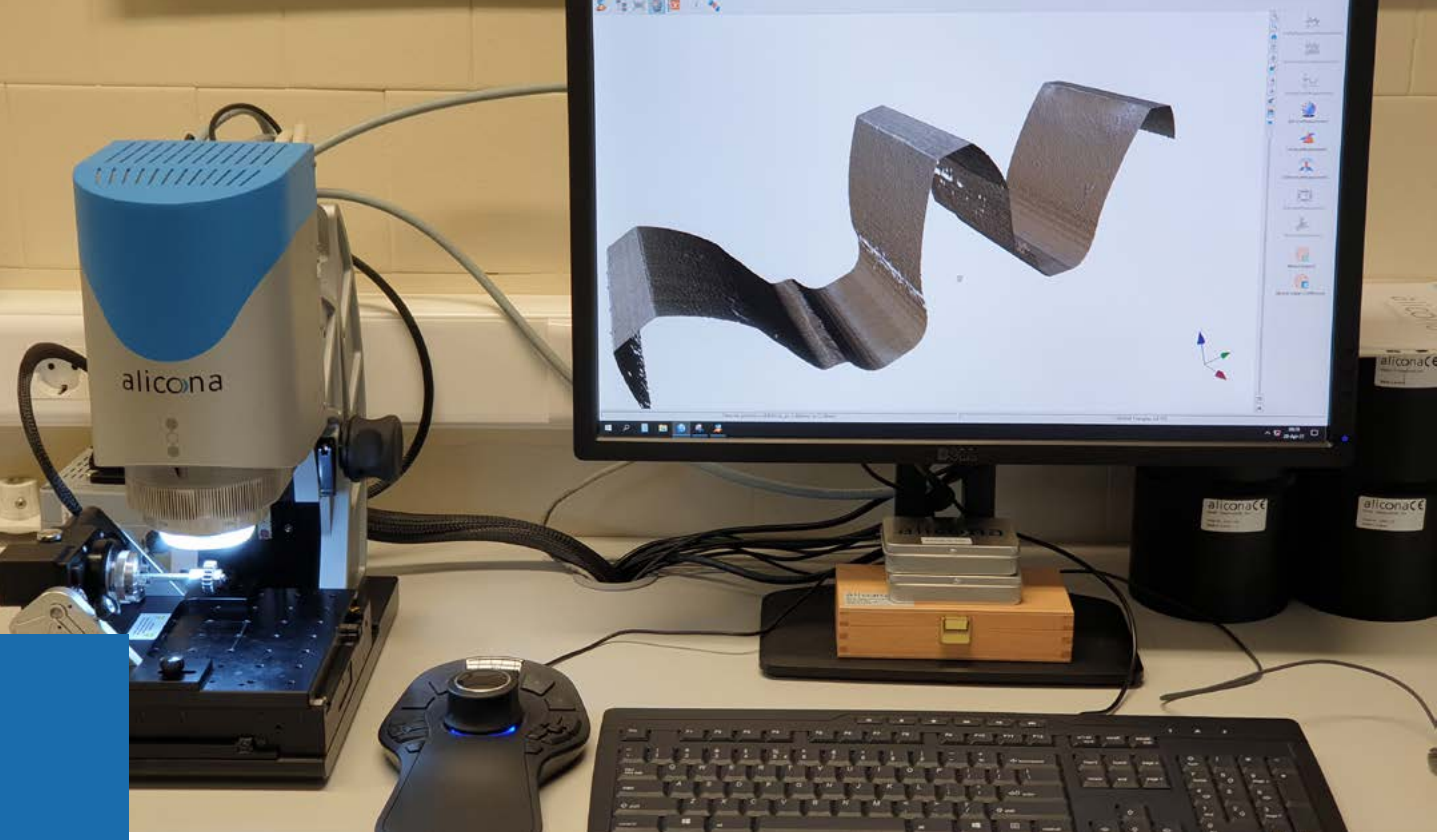


Photo: Željko Stevanić, IFP d.o.o

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. dr. Davorin Kramar
DEPARTMENT MEMBERS Assist. dr. Damir Grguraš, Assist. Mark Porenta, Stella Cavalleri

ORIGINAL SCIENTIFIC ARTICLES

CICA, Djordje, SREDANOVIĆ, Branislav, TEŠIĆ, Saša, KRAMAR, Davorin. Predictive modeling of turning operations under different cooling/lubricating conditions for sustainable manufacturing with machine learning techniques. Applied computing and informatics. 2024, vol. 20, no. 1/2, str. 162-180, ilustr. ISSN 2210-8327.

SREDANOVIĆ, Branislav, CICA, Djordje, BOROJEVIĆ, Stevo, TEŠIĆ, Saša, KRAMAR, Davorin. Optimization of superalloy Inconel 718 micro-milling process by combined Taguchi and multi-criteria decision making method. Journal of the Brazilian Society of Mechanical Sciences and Engineering. [Print ed.]. 2024, vol. 46, article number 423, str. 1-14, ilustr. ISSN 1678-5878.

SREDANOVIĆ, Branislav, BOROJEVIĆ, Stevo, CICA, Djordje, TEŠIĆ, Saša, JOKIĆ, Dajana, KRAMAR, Davorin. Energy consumption analysis and parameter optimization in high-feed milling operation. Proceedings on engineering sciences. 2024, vol. 6, no. 2, str. 587-592, ilustr. ISSN 2683-4111.

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.

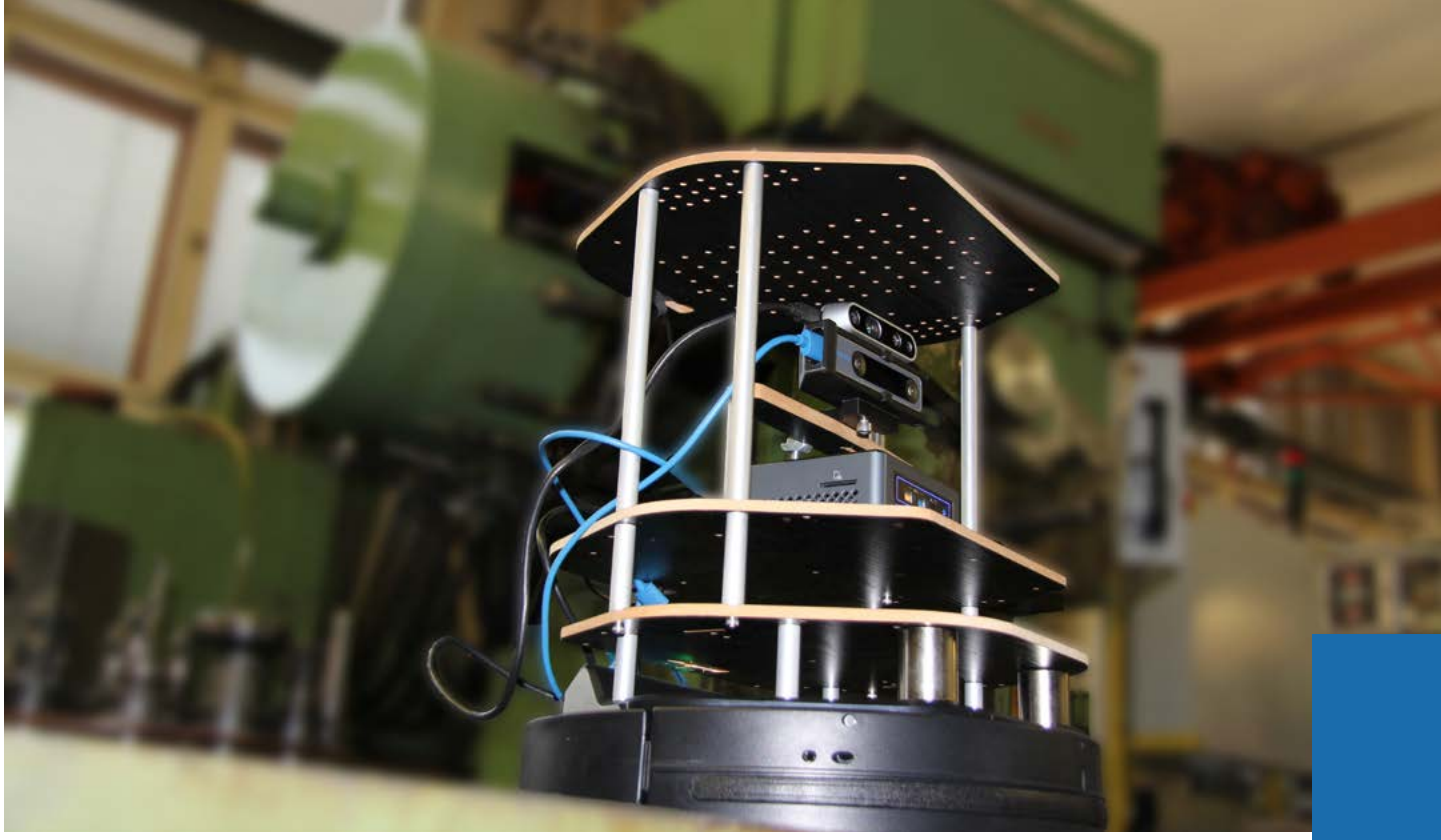


Photo: Željko Stevanić, IFP d.o.o

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. dr. Podržaj Primož

DEPARTMENT MEMBERS Assist. Prof. dr. Berlec Tomaž, Assist. Prof. dr. Bračun Drago, Assist. dr. Corn Marko, Assist. Prof. dr. Jenko Marjan, Assist. prof. dr. Kozjek Dominik, Juriševič Anja, Kavčič Tadeja, Kelvišar Matic, Assist. Kozamernik Nejc, Assist. Malus Andreja, Assist. Pleterski Jan, Assist. dr. Požrl Tomaž, Assist. Puc Jernej, Assist. Prof. dr. Rihar Lidija, Assist. dr. Ravnikar Dunja, Assist. dr. Rožman Nejc, Rupert Dominik, Assist. dr. Selak Luka, Assist. prof. dr. Škulj Gašper, Assist. Prof. dr. Vrabič Rok, Assist. dr. Žužek Tena, Assist. Jure Dvoršak, Assist. Benko Loknar Martina, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

KOZJEK, Dominik, PORTER, Conor, CARTER, Fred M., MOGONYE, Jon-Erik, CAO, Jian. Data-driven prediction of inter-layer process condition variations in laser powder bed fusion. Additive manufacturing. [Spletna izd.]. May 2024, vol. 88, [article no.] 104230, str. 1-15, ilustr. ISSN 2214-7810.

SAMAEI, Arash, PORTER, Conor, KOZJEK, Dominik, MOGONYE, Jon-Erik, CAO, Jian, WAGNER, Gregory J. Understanding coaxial photodiode-based multispectral pyrometer measurements at the overhang regions in laser powder bed fusion for part qualification. Additive manufacturing. [Print ed.]. Aug. 2024, [article no.] 104398, vol. 93, str. 1-17, ilustr. ISSN 2214-8604.

BERLEC, Tomaž, PEPERKO, Aljoša. A model for a green, lean sustainable improvement with performance measurement. Applied sciences. 2024, vol. 14, iss. 20, art. 9291, str. 1-12, ilustr. ISSN 2076-3417.

CARTER, Fred M., PORTER, Conor, KOZJEK, Dominik, SHIMOYOSHI, Kento, FUJISHIMA, Makoto, IRINO, Naruhiro, CAO, Jian. Machine learning guided adaptive laser power control in selective laser melting for pore reduction. CIRP annals. 2024, vol. 73, iss. 1, str. 149-152, ilustr. ISSN 0007-8506.

REZNICHENKO, Igor, PODRŽAJ, Primož, PEPERKO, Aljoša. Variable time step algorithm for transient response analysis for control and optimization. Fractal and fractional. 2024, vol. 8, iss. 12, [art. no.] 710, str. 1-16, ilustr. ISSN 2504-3110.

ŽUŽEK, Tena, VRABIČ, Rok, ZDEŠAR, Andrej, ŠKUL], Gašper, BANFI, Igor, BOŠNAK, Matevž, ZALETEL], Viktor, KLANČAR, Gregor. Simulation-based approach for automatic roadmap design in multi-AGV systems. IEEE transactions on automation science and engineering. [Print ed.]. Oct. 2024, vol. 21, no. 4, str. 6190-6201, ilustr. ISSN 1545-5955.

RIHAR, Lidija, JENKO, Marjan. QFD with statistical ranking – a hydropower turbine case study. International journal of simulation modelling. June 2024, vol. 23, no. 2, str. 239-250, ilustr. ISSN 1726-4529.

DUAN, Songlin, KOZJEK, Dominik, MEHR, Edward, ANDERS, Mark, CAO, Jian. Forming force prediction in double-sided incremental forming via GNN-based transfer learning. Journal of manufacturing processes. [Online ed.]. Jun. 2024, vol. 120, str. 867-877, ilustr. ISSN 2212-4616.

REZNICHENKO, Igor, PODRŽAJ, Primož, PEPERKO, Aljoša. Calculation of stationary magnetic fields based on the improved quadrature formulas for a simple layer potential. Mathematics. 2024, vol. 12, iss. 1, [article no.] 21, str. 1-16, ilustr. ISSN 2227-7390.

BRAČUN, Drago, SELAK, Luka, KLOBČAR, Damjan, KATIĆ, Marko, MARKUČIĆ, Damir. Intrusive laser triangulation method for non-contact detection of voids in translucent composites. NDT & E International. [Print ed.]. Jul. 2024, vol. 145, [article no.] 103143, str. 1-9, ilustr. ISSN 0963-8695.

SMAGOWICZ, Justyna, SZWED, Cezary, BERLEC, Tomaž. An Assortment–quantity optimization problem in printing industry using simulation modelling. Sustainability. 2024, vol. 16, iss. 4, [article no.] 1693, str. 1-25, ilustr. ISSN 2071-1050.

DOCTORAL DISSERTATIONS

MALUS, Andreja. Večagentni sistem za porazdeljeno krmiljenje kibernetsko-fizičnih sistemov : doktorsko delo. Mentor: Rok Vrabič

PROJECTS

Erasmus+. TET. The Evolving Textbook. Primož Podržaj. 1.9.2022 - 31.8.2025

Erasmus+. BLISS. Blended Learning Implementation for reSilient, acceSsible and efficient higher education. Primož Podržaj. 1.2.2022 - 31.1.2025

Erasmus+. DERHE. Digital Education Readiness in the field of Higher Education. Tomaž Berlec. 1.12.2023 - 30.11.2026

Erasmus+. FabLab. Developing competences on the Internet of Things through digital fabrication labolatories. Tomaž Berlec. 1.9.2022 - 31.8.2025

Erasmus+. TAI. Teaching Artificial Intelligence. 1.9.2024 - 31.8.2027

Erasmus+. GEMS. Graceful Equalising of Mechatronics Students. Gašper Škulj. 1.11.2022 - 31.10.2025

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Rok Vrabič. 1.1.2024 – 30.6.2026

Slovenian Research Agency. Development of a self-learning system for optimizing the driving rules of autonomous transport vehicles and their temporally and spatially coordinated activities. Rok Vrabič. 1. 10. 2021 – 30. 9. 2024

FLEXIDO d.o.o. Izvedba optimizacije in prehod iz ročne na avtomatizirano proizvodno celico v okviru projekta Oplast. Tomaž Berlec. 12.12.2024 - 30.3.2025

European Space Agency ESA. SWAM. Self-organising millirobot swarms for autonomous modification of unknown, granular terrain. Rok Vrabič. 1.1.2024 - 31.12.2024

AWARDS AND ACHIEVEMENTS

Sr. Instr. Dr. Igor Petrović received an award of the Faculty of Mechanical Engineering for excellence in teaching.

Assist. Prof. Dr. Dominik Kozjek received an award of the Faculty of Mechanical Engineering for excellence in teaching.

Photo: Željko Stevanić, IFP d.o.o

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. dr. Rok Petkovšek

DEPARTMENT MEMBERS Assist. Prof. dr. Vid Agrež, Assist. dr. Darja Horvat, Assist. dr. Žiga Lokar, Assist. Prof. dr. Jaka Mur, Assist. dr. Jaka Petelin, Assist. dr. Uroš Orthaber, Assist. dr. Luka Cerne, Assist. Jernej Jan Kočica, Assist. Matevž Marš, Assist. Miha Jelenčič, Assist. Janko Tuta, Assist. Gašper Hribar, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

PETELIN, Jaka, MARŠ, Matevž, MUR, Jaka, PETKOVŠEK, Rok. Managing residual heat effects in femtosecond laser material processing by pulse-on-demand operation. Journal of manufacturing and materials processing. [Online ed.]. 2024, vol. 8, no. 6, art. 254, str. 1-11, ilustr. ISSN 2504-4494.

AGREŽ, Vid, LOKAR, Žiga, PETKOVŠEK, Rok. Laser induced microbubbles as an alternative driver for liquid pumping. Optics and laser technology. [Print ed.]. Oct. 2024, vol. 177, [article no.] 111235, str. 1-9, ilustr. ISSN 0030-3992.

REUTER, Fabian, MUR, Jaka, PETELIN, Jaka, PETKOVŠEK, Rok, OHL, Claus-Dieter. Shockwave velocimetry using wave-based image processing to measure anisotropic shock emission. Physics of fluids. Jan. 2024, vol. 36, iss. 1, [article no.] 017127, str. 1-9, ilustr. ISSN 1070-6631.

MUR, Jaka, REUTER, Fabian, AGREŽ, Vid, PETKOVŠEK, Rok, OHL, Claus-Dieter. Optic generation and perpetuation of acoustic bubble clusters. Ultrasonics sonochemistry. Nov. 2024, vol. 110, [art.] 107023, str. 1-9, ilustr. ISSN 1350-4177.

PATENTS

AGREŽ, Vid, PETELIN, Jaka, PETKOVŠEK, Rok, VREČKO, Andrej. A simple laser with an improved pump system for generating laser pulses on demand = Laser simple doté d'un système de pompe amélioré pour générer des impulsions laser à la demande = Einfacher laser mit verbessertem pumpsystem zur erzeugung von laserpulsen auf anfrage : European patent specification EP 3 928 387 B1, 2024-06-05. Munich: European Patent Office, 2024.

PROJECTS

Horizon Europe. ENLIGHTEN. European Non-Line-of-Sight Optical Imaging. Rok Petkovšek. 1.12.2022 - 30.11.2026

Slovenian Research and Innovation Agency. Generation of ultra-short laser pulses for very high speed and highly adaptable parallel microprocessing. Rok Petkovšek. 1.10.2021 – 30.9.2024

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Rok Petkovšek. 1.1.2024 – 30.6.2026

Photo: UL FME Archive

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. dr. Roman Šturm

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

ORIGINAL SCIENTIFIC ARTICLES

ŠMALC, Jan, ZAKY, Adam, MARKOLI, Boštjan, ŠTURM, Roman. The impact of small Zr addition to Al–Ni cast alloy for elevated temperature applications. Journal of Materials Research and Technology. Sep.–Oct. 2024, vol. 32, str. 1928-1936.

BABIČ, Matej, ŠTURM, Roman, HORNAK, Peter. Modeling roughness surface Rp of 3D selective laser melting metal materials. Kovové materiály. 2024, vol. 62, no. 4, str. 235-244. ISSN 0023-432X.

BERGANT, Zoran, ŠTURM, Roman, KEK, Tomaž, HALILOVIČ, Miroslav, MAČEK, Andraž. The effects of loading angles on the failure of cross-ply notched bio-basalt composites. Polymer testing. Nov. 2024, vol. 140, art. 108609, str. 1-13, ilustr. ISSN 0142-9418.

KEK, Tomaž, ŠTURM, Roman, BERGANT, Zoran. Tension and shear behaviour of basalt fiber bio-composites with digital image correlation and acoustic emission monitoring. Polymers. 2024, vol. 16, iss. 10, str. 1-14, ilustr. ISSN 2073-4360.

BABIČ, Matej, KOVAČIČ, Miha, FRAGASSA, Cristiano, ŠTURM, Roman. Selective laser melting : a novel method for surface roughness analysis. Strojniški vestnik. July-Aug. 2024, vol. 70, no. 7/8, str. 313-324, ilustr. ISSN 0039-2480.

Photo: UL FME Archive

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 • Surface modification technologies

DEPARTMENT HEAD Assoc. Prof. dr. Damjan Klobčar
DEPARTMENT MEMBERS Assist. Prof. dr. Uroš Trdan, Assist. Mirza Imširović, Prof. dr. Kosec Borut, Jaka Lavrih, Assist. dr. Aljaž Ščetinec, Assist. dr. Matej Pleterski

ORIGINAL SCIENTIFIC ARTICLES

BUŠIĆ, Matija, ŠOLIĆ, Sanja, TROPŠA, Vlado, KLOBČAR, Damjan. Influence of flux agent composition in A-TIG welding Of Cu-ETP sheets. International journal of mining, materials, and metallurgical engineering. 2024, vol. 10, str. 8-16, ilustr. ISSN 2562-4571.

BUŠIĆ, Matija, ŠOLIĆ, Sanja, TROPŠA, Vlado, KLOBČAR, Damjan. Influence of flux agent composition on the ionization potential in A-TIG welding of the electrolytic tough pitch copper (Cu-ETP) sheets. Journal of Materials Research and Technology. Mar./Apr. 2024, vol. 29, str. 1253-1261, ilustr. ISSN 2238-7854.

IMŠIROVIĆ, Mirza, TRDAN, Uroš, KLOBČAR, Damjan, BRAČUN, Drago, NAGODE, Aleš, BERTHE, Laurent. Mitigating defects in directed energy deposited aluminium 5356 alloy through in-situ workpiece vibration. Journal of Materials Research and Technology. Nov.–Dec. 2024, vol. 33, str. 1581–1599, ilustr. ISSN 2238-7854.

LOGAR, Andraž, KLOBČAR, Damjan, NAGODE, Aleš, TRDAN, Uroš, ČERNIVEC, Gregor, SHARMA, Abhay. Advanced analysis of the properties of solid-wire electric contacts produced by ultrasonic welding and soldering. Materials. jan. 2024, vol. 17, iss. 2, [article no.] 334, str. 1-15, ilustr. ISSN 1996-1944.

ZDRAVKOVIĆ, Nataša, KLOBČAR, Damjan, MILČIĆ, Dragan, ZUPANČIČ, Matevž, ŽUŽEK, Borut, MILČIĆ, Miodrag, ĐURIĆ, Aleksija. Influence of surface preparation of aluminum alloy AW-5754 and stainless steel X5CRNI18-10 on the properties of bonded joints. Materials. May 2024, vol. 17, iss. 11, [article no.] 2561, str. 1-19, ilustr. ISSN 1996-1944.

LOGAR, Andraž, KLOBČAR, Damjan, TRDAN, Uroš, NAGODE, Aleš, ČERNIVEC, Gregor, VUHERER, Tomaž. Impact of ultrasonic welding parameters on weldability and sustainability of solid copper wires with and without varnish. Materials. 2024, vol. 17, iss. 20, art. 5033, str. 1-17, ilustr. ISSN 1996-1944.

ELKHALKI, Boutaina, GUERBOIS, Maxime, TRDAN, Uroš, BERTHE, Laurent. Implementation of the Almen intensity for the characterization of laser shock peening. Optics and laser technology. [Print ed.]. Aug. 2024, vol. 175, [article no.] 110724, str. 1-9, ilustr. ISSN 0030-3992.

PROJECTS

Slovenian Research and Innovation Agency. The influence of the thermal history on the microstructure and mechanical properties of additively manufactured materials. Damjan Klobčar. 1.1.2024 - 31.12.2027

Erasmus+. ANGIE. Academic Network for Green and Innovative Europe. Damjan Klobčar. 1.9.2023 - 28.2.2026

COST. Euro-MIC. New paths for science, sustainability and standards. Uroš Trdan. 26.10.2021 – 25.10.2025

Erasmus+. SMARTIE. Synergistic Management and Advancement of Artificial intelligence in European Higher Education. Damjan Klobčar. 1.10.2024 - 30.9.2027

Kolektor Mobility d.o.o. Raziskovalno in razvojno delo na področju spajanja bakra in bakrenih zlitin. Damjan Klobčar. 9.2.2023 - 30.11.2026

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.

Photo: Željko Stevanić, IFP d.o.o

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 Prof. dr. Matija Jezeršek

DEPARTMENT MEMBERS Assoc. Prof. dr. Peter Gregorčič, Assist. dr. Aleš Babnik, Assist. dr. Urban Pavlovčič, Assist. dr. Ladislav Grad, Assist. dr. Nejc Lukač, Assist. Luka Hribar, Assist. dr. Daniele Vella, Assist. dr. Matjaž Kos, Assist. Gaia Kravanja, Assist. Tine Brežan, Assist. Rida Ahmed, Assist. dr. Eva Kranjc, Assist. Dominik Šavli, Assist. dr. Jure Košir, Jasna Gornik

ORIGINAL SCIENTIFIC ARTICLES

LUKAČ, Matjaž, KOŠIR, Jure, ŽEL, Tilen, KAZIČ, Marko, ŠAVLI, Dominik, JEZERŠEK, Matija. Influence of tissue desiccation on critical temperature for thermal damage during Er:YAG laser skin treatments. Lasers in surgery and medicine. Jan. 2024, vol. 56, iss. 1, str. 107-118, ilustr. ISSN 1096-9101.

STRAUS, Izidor, KRAVANJA, Gaia, HRIBAR, Luka, KRIEGL, Raphael, JEZERŠEK, Matija, SHAMONIN, Mikhail, DREVENŠEK OLENIK, Irena, KOKOT, Gašper. Surface modification of magnetoactive elastomers by laser micromachining. Materials. Mar. 2024, vol. 17, iss. 7, art. no. 1550, 12 str., ilustr. ISSN 1996-1944.

VELLA, Daniele, PEREIRA, Diogo A., MRZEL, Aleš, VENGUST, Damjan, DRNOVŠEK, Aljaž, ARNAUT, Luís G., SERPA, Carlos, JEZERŠEK, Matija. Picosecond photoacoustic generation of ultrasounds with composites of graphene-decorated gold nanoparticles. Nano energy. [Online ed.]. 2024, vol. 131, part a, art. 110236, str. 1-12, ilustr. ISSN 2211-3282.

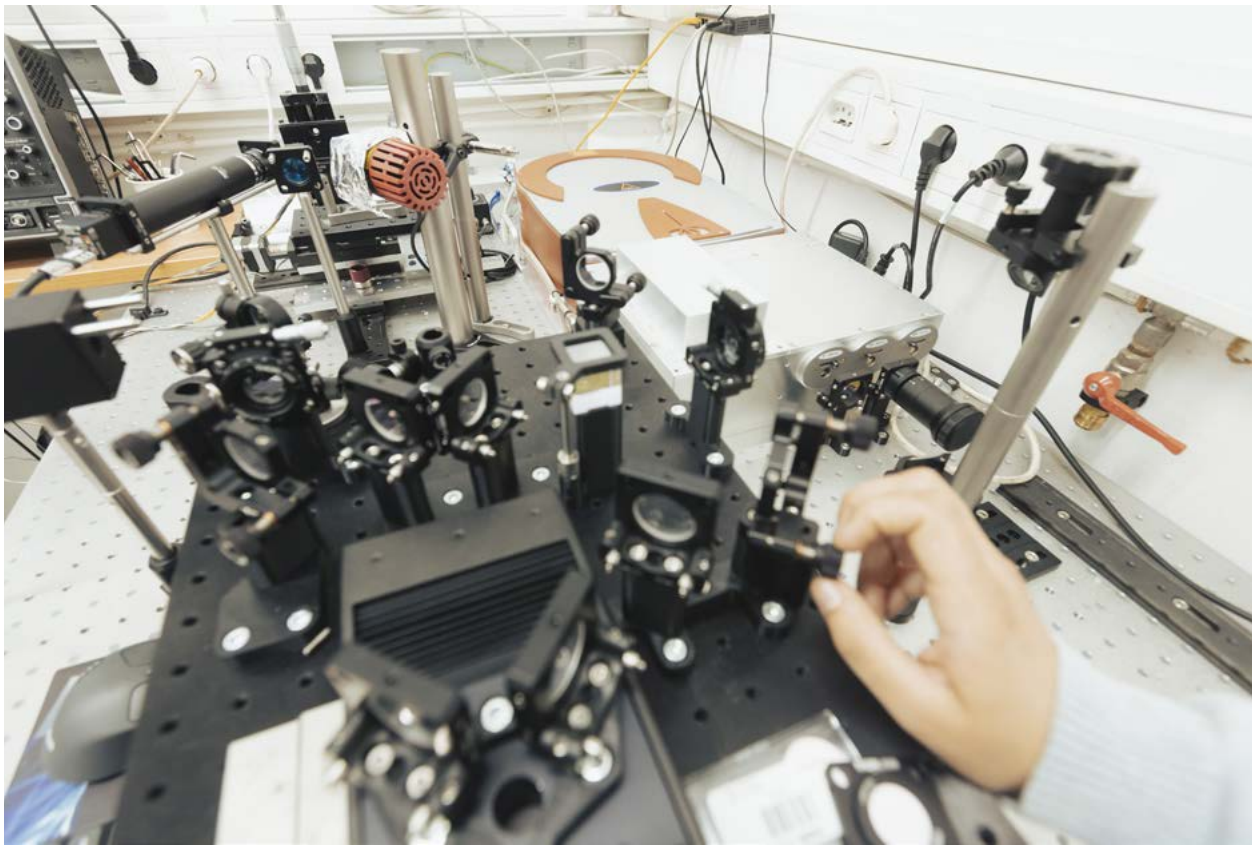


Photo: Željko Stevanić, IFP d.o.o

KAVČIČ, Aljaž, PODLIPEC, Rok, KRIŠEL], Ana, JELEN, Andreja, VELLA, Daniele, HUMAR, Matjaž. Intracellular biocompatible hexagonal boron nitride quantum emitters as single-photon sources and barcodes. Nanoscale. 2024, vol. 16, iss. 9, str. 4691–4702, ilustr. ISSN 2040-3372.

KRIEGL, Raphael, JEZERŠEK, Matija, KRAVANJA, Gaia, HRIBAR, Luka, MUKHI, Soham M., KOKOT, Gašper, DREVENŠEK OLENIK, Irena, SHAMONIN, Mikhail. Tunable rebound of millimeter-sized rigid balls by magnetic actuation of elastomer-based surface microstructures. Smart materials and structures. [Print ed.]. May 2024, vol. 33, no. 6, art. no. 067001, 11 str., ilustr. ISSN 0964-1726.

VOLK, Marko, MOLAN, Katja, ŠAVLI, Dominik, TERLEP, Saša, LEVIČNIK HOEFFERLE, Špela, GAŠPIRC, Boris, LUKAČ, Matjaž, JEZERŠEK, Matija, STOPAR, David. Biofilm removal from difficult-to-reach places via secondary cavitation within a constrained geometry mimicking a periodontal/peri-implant pocket. Ultrasonics sonochemistry. Mar. 2024, vol. 104, [article no.] 106832, str- 1-8, ilustr. ISSN 1350-4177.

PATENTS

LUKAČ, Nejc, LUKAČ, Matjaž, JEZERŠEK, Matija, GREGORČIČ, Peter. Cleaning system and method for operating the cleaning system : United States patent US 11,964,311 B2, 2024-04-23. Alexandria: United States Patent and Trademark Office, 2024.

MRZEL, Aleš, VELLA, Daniele, JEZERŠEK, Matija. Preparation process of graphene dispersion in PDMS with the simultaneous use of ultrasound and vacuum = Herstellungsverfahren für Graphendispersion in PDMS unter gleichzeitiger Verwendung von Ultraschall und Vakuum = Procédé de préparation d'une dispersion de graphène dans du pdms par utilisation simultanée d'ultrasons et de vide : European patent specification EP 4 282 905 B1, 2024-08-24. Munich: European Patent Office, 2024.

DOCTORAL DISSERTATION

TAŠIČ MUC, Blaž. Ojačenje optodinamsko generiranih tlačnih valov globoko pod obsevano površino : doktorsko delo. Mentor: Matija Jezeršek

PROJECTS

Slovenian Research and Innovation Agency. LaserInSMArT. Engineering of future innovative and smart hybrid materials by combining laser-functionalized metals and living cells. 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

Slovenian Research and Innovation Agency. GREENTECH. Hybrid Technologies for Green Factories of the Future. Matija Jezeršek. 1.1.2024 – 30.6.2026

Slovenian Research and Innovation Agency. 2D-UltraS. Two-dimensional materials-based piezophotonic composites for tailor-made ultrasounds stimulation in biological systems. Daniele Vella. 1.10.2023 – 30.9.2026

AWARDS AND ACHIEVEMENTS

Assist. Luka Hribar received an award of the Faculty of Mechanical Engineering for excellence in teaching.

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, Aleš Lavrič

ACTIVITIES

- Organization of indoor sports activities for students (basketball, volleyball, futsal, badminton, floorball, fitness, dancing...)
- Organiation of outdoor sports activities for students (hiking, alpine skiing, running, kayaking...)
- Cooper's physical fitness testing for students
- Participation in various competitions of University of Ljubljana or Slovenian university sports association (basketball league, volleyball league, futsal league, various one day tournaments)

THE BEST PERFORMANCES OF FME STUDENTS AND EMPLOYEES IN 2024 COMPETITONS

The Faculty of Mechanical Engineering football team placed second in the University Football League and second in the University Football Tournament.
The Faculty of Mechanical Engineering basketball team placed third in the University Basketball League.
Dino Vinkovič was part of the University of Ljubljana team that won the Beach Volley University National Championship.
Dominik Burgar was part of the University of Ljubljana team that won the Volleyball University National Championship.
Luka Ferjančič and Žiga Ferjančič were part of the University of Ljubljana team that won the Basketball University National Championship.

Blaž Vodopivec was part of the University of Ljubljana team that placed second in the Football University National Championship.

Uroš Žnidaršič placed first among University of Ljubljana employees in the University orienteering competition.

Matevž Kunc placed third among University of Ljubljana employees in the University orienteering competition.

AWARDS AND ACHIEVEMENTS

Instr. Žiga Bratuž received an award of the Faculty of Mechanical Engineering for excellence in teaching.

Photo: UL FME Archive

Mathematics Research Team RSMAT

DEPARTMENT HEAD Prof. dr. Janez Žerovnik

DEPARTMENT MEMBERS Prof. ddr. Žerovnik, Assoc. Prof. dr. Aljoša Peperko, Assist. Prof. dr. Boštjan Gabrovšek, Assist. Prof. dr. Darja Rupnik Poklukar, Assist. dr. Helena Zakrajšek, Assist. dr. Brezovnik Simon, Teja Pirnat

ORIGINAL SCIENTIFIC ARTICLES

BREZOVNIK, Simon, RUPNIK POKLUKAR, Darja, ŽEROVNIK, Janez. The 2-rainbow domination number of Cartesian product of cycles. Ars mathematica contemporanea. [Tiskana izd.]. 2024, vol. , nr. , str. 1-16, ilustr. ISSN 1855-3966.

BREZOVNIK, Simon. Kekulé structure of angularly connected even ring systems. Axioms. 2024, vol. 13, iss. 12, [art. no.] 827, str. 1-14, ilustr. ISSN 2075-1680.

BREZOVNIK, Simon, RUPNIK POKLUKAR, Darja, ŽEROVNIK, Janez. The 2-rainbow domination number of Cartesian bundles over cycles. Central European journal of operations research. 2024, vol. , iss. , str. 1-19, ilustr. ISSN 1613-9178.

ŠADL PRAPROTNIK, Ada, VAVPETIČ, Aleš, ŽAGAR, Emil. Optimal one-sided approximants of circular arc. Computer Aided Geometric Design. Dec. 2024, vol. 115, [article no.] 102401, 13 str., ilustr. ISSN 0167-8396.

GABROVŠEK, Boštjan, ŽEROVNIK, Janez. A fresh look at a randomized massively parallel graph coloring algorithm. Croatian operational research review : CRORR. [Tiskana izd.]. 2024, vol. 15, no. 2, str. 105-117, ilustr. ISSN 1848-0225.

BREZOVNIK, Simon, CHE, Zhongyuan, TRATNIK, Niko, ŽIGERT PLETERŠEK, Petra. Outerplane bipartite graphs with isomorphic resonance graphs. Discrete applied mathematics. [Print ed.]. Jan. 2024, vol. 343, str. 340-349.

ŽEROVNIK, Janez. Rainbow domination regular graphs that are not vertex transitive. Discrete applied mathematics. [Online ed.]. 2024, vol. 349, str. 144-147, ilustr. ISSN 1872-6771.

ŽEROVNIK, Janez. On rainbow domination of generalized Petersen graphs P (ck, k). Discrete applied mathematics. [Print ed.]. Nov. 2024, vol. 357, str. 440-448. ISSN 0166-218X.

DROLC, Aleš, ŽEROVNIK, Janez. Comparability of slovenian general matura mathematics exams at basic and higher level. Journal of International Scientific Publication : Educational Alternatives. 2024, vol. 22, str. 43-56, ilustr. ISSN 1314-7277.

LINS, Brian, PEPERKO, Aljoša. Inequalities on the essential joint and essential generalized spectral radius. Journal of mathematical inequalities. 2024, vol. 18, no. 4, str. 1489–1514. ISSN 1848-9575.

BOGDANOVIĆ, Katarina, PEPERKO, Aljoša. Monotonicity properties of weighted geometric symmetrizations. Journal of mathematical inequalities. 2024, vol. 18, no. 4, str. 1535–1546. ISSN 1848-9575.

MÜLLER, Vladimir, PEPERKO, Aljoša. On some aspects of spectral theory for infinite bounded non-negative matrices in max algebra. Linear and multilinear algebra. 2024, vol. 72, iss. 9, str. 1535-1554. ISSN 0308-1087.

DA SILVA, Fernando Bruno, GABROVŠEK, Boštjan, KORPACZ, Marta, LUCZKIEWICZ, Kamil, NIEWIECZERZAL, Szymon, SIKORA, Maciej, SULKOWSKA, Joanna I. Knots and □□-curves identification in polymeric chains and native proteins using neural networks. Macromolecules. May 2024, vol. 57, iss. 9, str. 4599-4608, ilustr. ISSN 0024-9297.

REZNICHENKO, Igor, PODRŽAJ, Primož, PEPERKO, Aljoša. Calculation of stationary magnetic fields based on the improved quadrature formulas for a simple layer potential. Mathematics. 2024, vol. 12, iss. 1, [article no.] 21, str. 1-16, ilustr. ISSN 2227-7390.

PROJECTS

Slovenian Research and Innovation Agency. A computational library for knotted structures and applications. Boštjan Gabrovšek. 1.10.2022 - 30.9.2025

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 to 9th grade of primary school. To this end, every August we organize the Mechanical Engineering Summer Camp. In 2024, we organized it for the 11th consecutive year, which indicates that it is becoming a tradition. 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.

Photo: Željko Stevanić, IFP d.o.o

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. 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.

Photo: UL FME Archive

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.

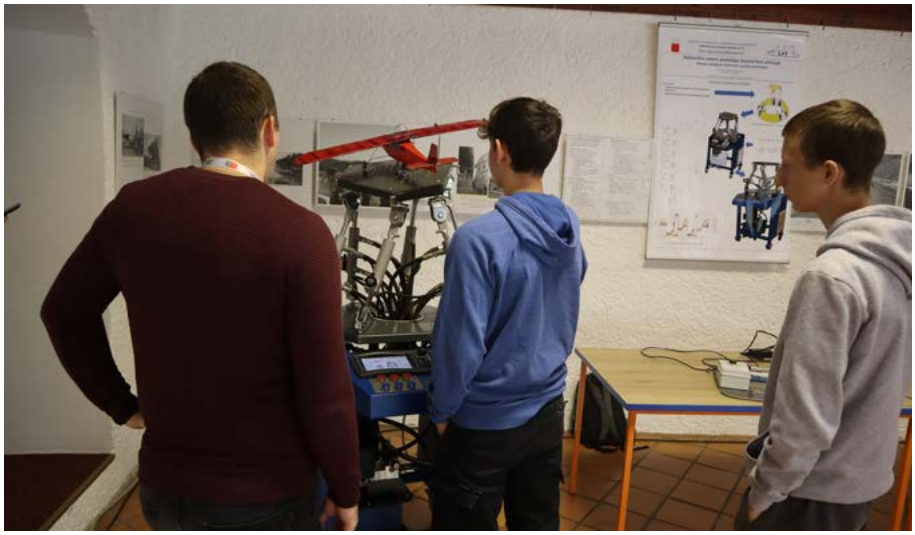


Photo: UL FME Archive

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.

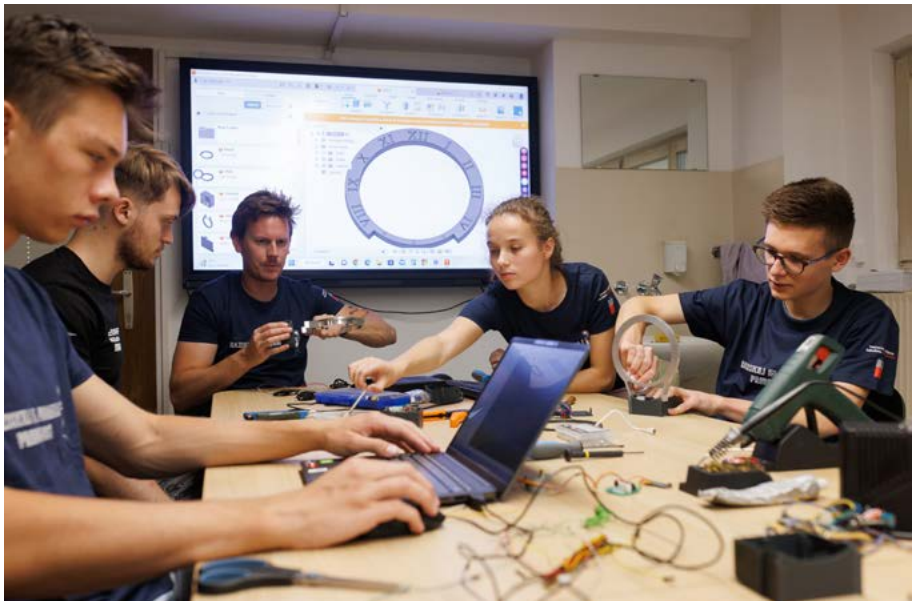


Photo: Željko Stevanovič, IFP d.o.o.

OPEN LABORATORY – PESKOVNIK

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.

Photo: Željko Stevanič, IFP d.o.o.

Photo: Željko Stevanič, IFP d.o.o.

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

SUMMER RESEARCH CAMP “EXPLORE AND PROPEL THE FUTURE"

At the Faculty of Mechanical Engineering of the University of Ljubljana, we organised the Summer Research Camp “Explore and Propel the Future” for the second consecutive year. This year, we hosted 30 students from twenty-two grammar school from all over Slovenia. The students had the opportunity to choose between twelve workshops covering a wide range of topics, from robotics and automation to new materials and energy solutions. Each workshop promoted practical work and creative thinking and at the same time presented the various aspects of the modern mechanical engineering to the students.

Photo: Željko Stevanič, IFP d.o.o.

University of Ljubljana,

Faculty of Mechanical Engineering

Aškerčeva cesta 6, 1000 Ljubljana, Slovenia

Telephone: +386 1 4771 200

Fax: +386 1 2518 567

E-mail: dekanat@fs.uni-lj.si

Splet: http://www.fs.uni-lj.si/

Issued by: University of Ljubljana, Faculty of Mechanical Engineering

Collected and edited by: Katja Pustovrh

Responsible editor: prof. dr. Mihael Sekavčnik

Design by: Toaster studio d.o.o.

Photography by: Archives of the Faculty of Mechanical Engineering

Printed by: Camera d.o.o.

Circulation: 70

Ljubljana, 2025

ISSN 2783-3970

Not for sale

FOLLOW US ON