



RESEARCH GROUPS CATALOGUE

Split, 2026

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GROUP FOR ELECTRICAL MEASUREMENTS AND SIGNAL PROCESSING (GELM)

Head of the Group:

Prof. Tonko Garma, PhD

<https://www.croris.hr/osobe/profil/30146?lang=en>

Scientific Fields:

Engineering / Electrical Engineering

Brief Description of the Research Group:

The research group specializes in the measurement, modeling, and diagnostics of power systems, with a particular focus on the development of advanced metrological and testing methods. Its core research activities include the development and application of power system disturbance simulators, as well as the calibration of non-sinusoidal voltages and currents to ensure measurement accuracy and the reliability of diagnostic procedures.

The group also develops metrological infrastructure to support smart grids, enabling accurate monitoring, analysis, and control of power systems in the context of digital transformation and the energy transition.

In addition, the group conducts research on advanced nanomaterials for applications in energy conversion and storage. This includes the development of novel materials and concepts for converting electrical energy into chemical energy carriers, as well as experimental investigations of electromechanical coupling in ferroelectric and defect-engineered metal oxides, with a particular emphasis on the role of defects and ionic dynamics in energy conversion and storage processes.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Goran Petrović, PhD
- Prof. Tomislav Kilić, PhD

2. EXPERTISE AND KNOW-HOW

- Measurement, modeling, and diagnostics of power systems
- Power system disturbance simulators and calibration of non-sinusoidal voltages and currents
- Metrological infrastructure for smart grids
- Cleanroom techniques (lithography, thin-film deposition, electrical transport measurements, and electron microscopy)

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory A244 - Laboratory for electrical measurements
- Laboratory A249

Equipment

- Calibrator: CALMET 300B
- STER synchrophasor measurement unit (PMU)
- Power quality meter: ION7650
- NI CompactRIO cRIO-9035 real-time controller
- LCR meter: HP 4284A
- Dynamic signal analyzer: HP 35665A
- Digital multimeter: HP 3458A
- High-voltage voltage transformer (VT): NMT 110/0.1/0.1 kV/kV/kV and high-voltage current transformer (CT): SMT 300(600)/1/1/1/1 A/A/A/A
- Generation and measurement of voltages up to 110 kV AC and 100 kV DC, and currents up to 2000 A AC and 200 A DC
- Measurement of very low electrical resistances (10 A and 200 A micro-ohmmeters) and very high electrical resistances (tera-ohmmeters with 5 kV and 110 kV test voltages)
- 10/0.4 kV, 630 kVA distribution transformer with a 10 kV oil circuit breaker integrated with a Siemens overcurrent protection system
- Inductive and acoustic partial discharge measurement system
- Thermal imaging camera with 320×240 pixel resolution and a measurement range from $-20\text{ }^{\circ}\text{C}$ to $+600\text{ }^{\circ}\text{C}$
- Diagnostic system for testing power transformers, voltage transformers, and current transformers
- 48 V lithium-ion and lead-acid battery packs, equipment for capacity measurements, and diagnostic instruments for determining State of Health (SOH) and State of Charge (SOC)
- Electromagnetic field strength spectrum analyzers for extremely low-frequency (ELF) fields and mobile communication networks
- Equipment for testing grounding (earthing) systems and determining the electrical properties of soil
- Process measurement instrumentation, including Class 1 sound level meter, illuminance meters, temperature and relative humidity sensors, anemometers, pressure gauges, and analyzers for the electrical properties of liquids.

4. KEY PROJECTS AND REFERENCES

- Power engineering measurements, modeling and diagnostics
- Power system disturbance simulator and non-sinusoidal voltages and currents calibrator
- Metrology infrastructure for support of the intelligent power grid

5. COLLABORATION OPPORTUNITIES

- Measurement and diagnostics of power systems
- Power quality measurement
- Determination of the geoelectrical and geothermal properties of soil

6. CONTACT

Head of Research Group: garma@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR PLANNING AND OPERATION OF POWER SYSTEMS WITH HIGH SHARES OF RENEWABLE ENERGY SOURCES (ENERGYgrid)

Head of the Group:

Prof. Damir Jakus, PhD

<https://www.croris.hr/osobe/profil/26729?lang=en>

<https://damir-jakus.from.hr/>

Scientific Fields:

Engineering – Electrical Engineering

Brief Description of the Research Group:

The research group develops advanced solutions for the analysis, optimization, and operation of modern power systems with high shares of renewable energy sources (RES). Its core expertise includes transmission and distribution network planning studies, grid integration analyses for new generation and demand, protection system coordination, techno-economic assessment of energy projects, electricity market analysis, optimal sizing of energy systems, and the application of advanced optimization and machine learning techniques through the development of specialized software tools.

The group's research aims to enhance the reliability, flexibility, and efficiency of future power systems while maintaining a strong focus on technology transfer and close collaboration with industry partners.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Josip Vasilj, PhD
- Prof. Ranko Goić, PhD

Other faculty researchers:

- Joško Novaković, MEng

2. EXPERTISE AND KNOW-HOW

- Optimization of transmission and distribution system operation with high penetration of renewable energy sources (RES) and electric vehicles (EVs)
- Development of specialized software tools and simulation models for the power industry
- Application of machine learning and deep learning methods for power system diagnostics and forecasting
- Transmission and distribution network development studies (long-term planning, congestion analysis, network development scenarios, etc.)
- Grid impact assessments for the integration of new generation units, energy storage systems, and electric vehicle charging infrastructure
- Verification of grid connection compliance with technical requirements, grid codes, and regulatory standards

- Protection system coordination and settings for transmission and distribution networks, including challenges associated with inverter-based resources
- Techno-economic assessment of energy projects and investments (LCOE, LCOH, feasibility studies, technology comparison, etc.)
- Optimal sizing of energy systems, including generation units, battery energy storage systems, EV charging infrastructure, and microgrids
- Electricity market analysis and optimization of market participation strategies for generation and consumption portfolios
- Application of advanced optimization techniques in power system planning and operation
- Machine learning and deep learning methods for forecasting and diagnostics of key power system parameters

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Power System Simulation and Real-Time Analysis
- Laboratory for Microgrids and Renewable Energy Systems
- Experimental Smart Grid Electric Vehicle Charging Laboratory

Equipment

- OPAL-RT real-time simulation platform for power systems and power electronics, including RT-LAB, ePHASORSim, and eHS software packages
- Engineering software: MATLAB/Simulink, PLECS, PowerFactory, NEPLAN, RT-LAB, ePHASORSim, eHS, GridLAB-D, OpenDSS, PowerCAD, WinDIS, EMTP-RV, EMTP-ATP, and others
- Microgrid laboratory testbed for implementing and validating control algorithms for photovoltaic systems and battery energy storage
- Photovoltaic modules based on different technologies and battery testing systems
- Meteorological station
- Electric vehicle charging infrastructure consisting of a 2×11 kW EVBox Elvi charging station, a 22 kW go-e mobile charger, and a backend management platform for charger monitoring and control
- Measurement equipment including oscilloscopes, electrical and non-electrical sensors, torque meters, and rotational speed measurement devices
- Optimization software and solvers: GAMS, GUROBI, and CPLEX

Advanced Computing Resources

- High-performance workstations for power system optimization using GAMS, PYOMO, JuMP, GUROBI, CPLEX, and related tools, as well as for machine learning and deep learning applications in power system diagnostics and forecasting

4. KEY PROJECTS AND REFERENCES

- **2025–2029** –FLEXsys: Implementation of Flexibility Resources and Advanced Control Algorithms for Modern Power Systems with High Shares of Renewable Energy Sources
- **2024–2026** – LUMINI2: Laboratory Model and Prototype of a Control and Monitoring System for Microgrids with Renewable Energy Sources and Hydrogen Technologies
- **2021–2023** – MsEVP: Research and Development of a Smart Grid Electric Vehicle Charging Station Integrated into a Rotary Parking Structure
- **2021–2023** – GridS: System for Establishing a Stable Electricity Distribution Network
- **2020–2025** – ADVANCE-RES: Application of Advanced Optimization and Machine Learning Methods in Planning and Operation of Power Systems with High Shares of Renewable Energy Sources

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with universities and research institutions, power utilities, transmission and distribution system operators (TSOs and DSOs), equipment manufacturers, engineering and consulting companies, and industrial partners in the planning, analysis, and optimization of power systems with high shares of renewable energy sources. Its particular expertise includes transmission and distribution network development studies, grid integration studies for new generation units, energy storage systems, and electricity consumers, verification of compliance with grid connection requirements, and the design and coordination of protection systems in networks with a high penetration of inverter-based resources. The group also offers extensive expertise in techno-economic assessment of energy projects and investments, optimal sizing of energy systems—including generation units, battery energy storage systems, electric vehicle charging infrastructure, and microgrids—as well as electricity market analysis and the development of market participation strategies. A key strength of the group is the development of specialized software tools and simulation models tailored to the specific needs of industrial partners, combined with the application of advanced machine learning and deep learning techniques for power system diagnostics and forecasting. Collaboration opportunities include joint research and innovation projects (including Horizon Europe, Interreg, and national HRZZ and NPOO funding programmes), technical and feasibility studies, expert reports and consulting services, development of specialized software tools, validation of control, protection, and optimization algorithms, technical support, professional training and continuing education, as well as access to the group's laboratory facilities and research infrastructure.

6. CONTACT

Head of Research Group: damir.jakus@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR MODELLING AND SIMULATION OF ELECTROMAGNETIC PHENOMENA IN POWER SYSTEMS (MOSEPES)

Head of the Group:

Assoc. Prof. Dino Lovrić, PhD

<https://www.croris.hr/osobe/profil/27637?lang=en>

Scientific Fields:

Engineering Sciences – Electrical Engineering

Brief Description of the Research Group:

The research group's areas of expertise include power system transient stability analysis, transient analysis and surge protection of wind farms, transient analysis and insulation coordination in power systems, the application of machine learning to power system transient stability, power system protection, analysis of electromagnetic interference in power systems, interpretation of geoelectrical soil survey results and geoelectrical soil surveying, lightning risk assessment, and analysis of grounding systems in power systems.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Petar Sarajčev, PhD
- Prof. Ivica Jurić-Grgić, PhD
- Assist. Prof. Ivan Krolo, PhD

2. EXPERTISE AND KNOW-HOW

- Transient analysis and surge protection of wind farms
- Transient analysis and insulation coordination in power systems
- Machine learning applications in power system transient stability
- Power system protection
- Analysis of electromagnetic interference in power systems
- Interpretation of geoelectrical soil characteristics
- Analysis of power system grounding systems and surge protection
- Lightning risk assessment
- Power system transient stability

3. RESEARCH INFRASTRUCTURE

Laboratories

- Electrical Installations Testing Laboratory
- Electromagnetic Compatibility (EMC) Laboratory
- Research Laboratory

Equipment

- Instruments for measuring low-frequency electric and magnetic field strength
- Dielectric strength testing equipment
- Thermal imaging camera

4. KEY PROJECTS AND REFERENCES

- Convergent OT–IT Energy Management System (EMS) for the Transition of Port Communities into Smart Low-Carbon Energy Hubs (SPIN Project)
- Vujević, S.; Modrić, T.; Lovrić, D. Testing the Geoelectrical Characteristics of the Soil at the Location of the Future 35/20 (10) kV Vrlika Substation. Commissioned by HEP ODS Ltd., Elektrodalmacija Split Distribution Area, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), University of Split, 2019.
- Sarajčev, P. Selection of the Generator Grounding Resistor for Kosinj Hydropower Plant. Commissioned by Projektni biro Split Ltd., Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), University of Split, 2021.
- Vujević, S.; Modrić, T.; Lovrić, D.; Krolo, I. Design of the Grounding System for the 35/20 (10) kV Vrlika Substation and Calculation of Transferred Potentials in the Grounding System. Commissioned by HEP ODS Ltd., Elektrodalmacija Split Distribution Area, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), University of Split, 2019.
- Sarajčev, P. Analysis of Electromagnetic Interference Between Adjacent Triplets of Shielded Generator Bus Ducts in Zakučac Hydropower Plant. Commissioned by Projektni biro Split Ltd., Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture (FESB), University of Split, 2011.

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration in areas including power system transient stability analysis, transient analysis and surge protection of wind farms, transient analysis and insulation coordination in power systems, machine learning applications for power system transient stability, power system protection, analysis of electromagnetic interference in power systems, geoelectrical soil surveying and interpretation of geoelectrical survey results, lightning risk assessment, and analysis of grounding systems in power systems.

6. CONTACT

Head of Research Group: dlovric@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR POWER SYSTEM PLANNING

Head of the Group:

Prof. Elis Sutlović, PhD

<https://www.croris.hr/osobe/profil/15117?lang=en>

Scientific Fields:

Engineering / Electrical Engineering

Brief Description of the Research Group:

The research group focuses on the planning, analysis, operation, and control of power systems in the context of the energy transition and the development of sustainable energy solutions. Its expertise includes strategic energy planning, the development and application of methods for power system analysis and expansion planning, and the optimization of power system operation and control. The group's research aims to enhance the security of supply, reliability, efficiency, and flexibility of power systems while supporting the integration of emerging technologies and renewable energy sources.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Tonći Modrić, PhD
- Prof. Nikša Kovač, PhD

Other faculty researchers:

- Marin Mandić

2. EXPERTISE AND KNOW-HOW

- Energy sector planning
- Power system planning and analysis
- Power system operation and control

3. RESEARCH INFRASTRUCTURE

Laboratories

The research group conducts its project-related research activities in Laboratories A247 and A325.

Equipment

- Typhoon HIL 606 real-time digital simulator (RTDS) with the integrated Typhoon HIL Control Center software suite.

4. KEY PROJECTS AND REFERENCES

Members of the research group have participated in the following research projects:

- Converged IT–OT Energy Management System (EMS) for the Transition of Port Communities into Smart Low-Carbon Energy Hubs (SPIN), 2024–2027
- Power System Disturbance Simulator and Non-Sinusoidal Voltage and Current Calibrator, Croatian Science Foundation, Project IP-2019-04-7292, 2020–2024
- Development and Operation of Power Systems with a High Penetration of Wind Power, Ministry of Science and Technology of the Republic of Croatia, Project No. 023-0361590-1654, 2007–2011
- Optimization of Planning and Operation of Hydropower Systems, Ministry of Science and Technology of the Republic of Croatia, Project No. 0023026, 2002–2006

5. COLLABORATION OPPORTUNITIES

The research group specializes in the planning, analysis, operation, and control of power systems, with particular emphasis on the challenges and opportunities arising from the energy transition, renewable energy integration, and the development of sustainable energy solutions. Collaboration opportunities include joint research and development projects, the development and validation of novel methods and algorithms, modelling and simulation, laboratory and Hardware-in-the-Loop (HIL) testing, demonstration projects, technical studies and analyses, as well as the preparation and implementation of national and international research projects. Potential areas of collaboration include:

- Power system planning and development – transmission and distribution network expansion planning and power system development scenario analysis
- Renewable energy integration – analysis of technical and operational challenges associated with integrating large-scale and distributed renewable energy sources
- Power system flexibility and energy storage – optimization of energy storage systems, management of flexible resources, and development of new approaches to improving power system flexibility
- Modelling, simulation, and validation – development of mathematical models and computational tools for power system analysis, including real-time simulation and Hardware-in-the-Loop (HIL) techniques for testing control systems, protection schemes, and energy equipment
- Microgrids and local energy systems – design, modelling, and optimization of microgrids, energy communities, and local energy systems with a high share of renewable energy sources and energy storage

6. CONTACT

Head of Research Group: Elis.Sutlovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR AUTOMATION AND ELECTRIC DRIVES

Head of the Group:

Prof. Božo Terzić, PhD

<https://www.croris.hr/osobe/profil/13848?lang=en>

Scientific Fields:

Engineering / Electrical Engineering

Brief Description of the Research Group:

The research group focuses on the development and application of advanced technologies in the fields of electrical machines, power electronic converters, and automated systems. Its expertise covers AC electrical machines and electric drives, power electronic converters, industrial automation, and advanced control systems. Particular emphasis is placed on electrical energy storage systems and their role in enhancing the flexibility, stability, and reliability of power grids. The group's research contributes to the development of energy-efficient, digitalized, and sustainable industrial and energy systems.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Marin Despalatović, PhD
- Assoc. Prof. Ozren Bego, PhD
- Assoc. Prof. Danijel Jolevski, PhD
- Assist. Prof. Goran Majić, PhD

2. EXPERTISE AND KNOW-HOW

- AC electrical machines and electric drives
- Power electronic converters
- Industrial automation
- Advanced control systems
- Electrical energy storage systems and power grid stabilization

3. RESEARCH INFRASTRUCTURE

Laboratories

- Electric Drives Laboratory (up to 50 kW)
- Electric Drives Laboratory (up to 350 kW)
- Automation and Control Systems Laboratory
- Containerized Electrical Energy Storage and Power Grid Stabilization System (300 kW / 150 kWh)

Equipment

- Electrical machines of various types and ratings (100 W to 350 kW)
- State-of-the-art power electronic converters up to 350 kW
- Programmable Logic Controllers (PLCs)
- Measurement equipment (electrical instruments, oscilloscopes, thermal imaging camera, impulse voltage generator, electrical and non-electrical sensors, torque and rotational speed measurement systems)
- Microprocessor-based systems
- Components for power electronic converters (IGBT modules, inductors, capacitors, electronic control boards, busbars)

4. KEY PROJECTS AND REFERENCES

- Development of Electric Drives for Crane Systems, ABB Sweden – FESB, Project Leader, international R&D project, 2009–2013.
- Development of Electric Drives for Crane Systems, CEC Germany – FESB, Project Leader, international R&D project, 2017–2025.
- Safer and More Efficient Cogeneration/Trigeneration Plants, Partners: FESB Split – Banko Ltd., Project Leader, EU-funded project, 2015–2016.
- Active Electrical Energy Storage System for Power Grid Stabilization, Partners: FESB Split – Sintaksa Ltd., EU-funded project, 2018–2021.

5. COLLABORATION OPPORTUNITIES

- Expertise in AC electrical machines and electric drives
- Development of power electronic converters for renewable energy sources and energy storage systems
- Industrial automation systems
- Advanced control methods for renewable energy systems integrated with electrical energy storage and power grid stabilization, including microgrids

6. CONTACT

Head of Research Group: Bozo.Terzic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ENERGY ELECTRONICS AND AUTOMATION

Head of the Group:

Prof. Dinko Vukadinović, PhD

<https://www.croris.hr/osobe/profil/2361?lang=en>

Scientific Field:

Engineering / Electrical Engineering

Brief Description of the Research Group:

The research group focuses on developing advanced solutions in the fields of power electronics, electric drives, and intelligent control systems. Its expertise includes the design and optimization of power electronic converters for renewable energy systems, the development of control systems for induction and switched reluctance machines, and the application of artificial intelligence methods in control and regulation. The group's research aims to improve the efficiency, reliability, and adaptability of power and drive systems while supporting the integration of renewable energy sources and the digital transformation of the energy sector.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Dinko Vukadinović, PhD
- Prof. Mateo Bašić, PhD
- Assist. Prof. Ivan Grgić, PhD

2. EXPERTISE AND KNOW-HOW

- Power electronic converters for renewable energy systems
- Control systems for induction and switched reluctance machines
- Artificial intelligence applications in control systems

3. RESEARCH INFRASTRUCTURE

Laboratories

- Power Electronics Research Laboratory (B310)

Equipment

- dSPACE DS1103 controller board
- dSPACE DS1104 controller boards
- dSPACE MicroLabBox real-time prototyping system
- Fluke Norma 4000 power analyzer
- Rohde & Schwarz HMC8015 power analyzer
- Programmable DC power supplies: Chroma 62050H-600S, Itech IT6006C-800-25, and Magna-Power Electronics SL50-30
- Tektronix MDO3014 oscilloscope

- Siglent SDS5034X oscilloscope
- LEM IT 60-S current sensors
- LEM CV 3-500 voltage sensors
- Fluke 80i-110s and Testec TT-CC 770 current probes
- Siemens four-quadrant power converters (52.5 kW and 6.3 kW)
- Magtrol TMB 308 and Magtrol TM 308 torque transducers
- Itech IT8615 electronic loads
- LARA100 processor system
- Hyundai N700 5.5 kW variable frequency drive

4. KEY PROJECTS AND REFERENCES

- HRZZ Project IP-2016-06-3319: Wind-Solar System for Optimized Residential Electric Generation, Croatian Science Foundation, 2017–2021.
- Energy-Stored Quasi-Z-Source Inverters for MVDC Grids, University of Split, SEA-EU collaboration with the University of Cádiz (Spain), May–November 2021.
- ERIGrid 2.0: Experimental Exploration of Model Predictive Control for Three-Phase Split-Source Inverters, European Research Infrastructure Supporting Smart Grid and Smart Energy Systems Research, Technology Development, Validation and Roll Out – Second Edition, 2024.
- SystE-mobility: Promoting Smart Industrial Development through Innovation in Advanced Electric Vehicle Training Systems. Project coordinator: S+B Systemtechnik Ltd. Co-financed by the European Union through the Integrated Territorial Programme 2021–2027.
- SURFER: Control Systems for Photovoltaic Power Plants. Institutional research project funded under Source 581 – Recovery and Resilience Facility, 2025–2029.

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with universities, research organizations, and industry partners in the fields of power electronics, electric drives, renewable energy, and advanced control systems for electric power applications. Potential areas of collaboration include the design, modeling, simulation, and experimental validation of power electronic converters for photovoltaic, wind, battery, and hybrid energy systems. Particular emphasis is placed on converter topologies that enhance the efficiency, reliability, and flexibility of modern power systems.

The group also collaborates on the development and testing of control systems for electric motor drives and generators, the application of artificial intelligence to optimize the operation of energy conversion and drive systems, and the development of laboratory, educational, and industrial solutions in power electronics. Collaboration may take the form of joint research projects, prototype development, laboratory testing and measurements, technology and knowledge transfer to industry, as well as the preparation of technical studies, expert analyses, and educational materials.

6. CONTACT

Head of Research Group: Dinko.Vukadinovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR PHOTOVOLTAIC SYSTEMS AND TECHNOLOGIES (PVST)

Head of the Group:
Prof. Tihomir Betti, PhD

<https://www.croris.hr/osobe/profil/2333?lang=en>

Scientific Field:
Engineering Sciences / Electrical Engineering

Brief Description of the Research Group

The research group focuses on the development, characterization, and application of photovoltaic (PV) technologies and systems. Its activities include research on solar cells, photovoltaic modules, and systems, encompassing experimental testing, performance evaluation, and modelling.

A particular emphasis is placed on the study of losses and degradation mechanisms affecting the efficiency and reliability of PV energy conversion, including the effects of soiling, shading, temperature, the solar irradiance spectrum, and other environmental factors. The group conducts long-term monitoring of PV systems under real operating conditions and develops methods for energy yield assessment, degradation analysis, and performance optimization. The research interests also include new application areas of photovoltaic technologies, including their integration into buildings and vehicles, as well as deployment on agricultural land and water surfaces.

In addition to its research activities, the group develops customized electronic measurement and monitoring systems and actively participates in research, development, and innovation projects in collaboration with academic and industrial partners.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Ivan Marasović, PhD
- Prof. Joško Šoda, PhD

Other faculty researchers:

- Tea Erceg, MEng in Electrical Engineering
- Antonio Vuletić, MEng in Electrical Engineering
- Spomenka Bován, MSc, Senior Lecturer

2. EXPERTISE AND KNOW-HOW

- Characterization and testing of solar cells, photovoltaic modules, and PV systems
- Long-term monitoring and performance analysis of photovoltaic systems under real operating conditions
- Analysis and quantification of losses in photovoltaic systems (soiling, shading, temperature effects, and other environmental influences)
- Identification and analysis of degradation mechanisms in photovoltaic modules and systems
- Energy production assessment and energy yield analysis
- Modelling, simulation, and optimization of photovoltaic system performance
- Design and sizing of photovoltaic systems for various applications
- Performance analysis, diagnostics, and condition monitoring of photovoltaic power plants
- Development of customized electronic measurement and monitoring systems for research and industrial applications
- Solar radiation measurement and modelling (spectral analysis and solar radiation components)

3. RESEARCH INFRASTRUCTURE

Laboratories

- Photovoltaic Systems Laboratory
- Micro- and Nanoelectronics Laboratory
- Electronic and Control Systems Laboratory
- Teaching Laboratory

Equipment

- Photovoltaic systems (PV modules based on different technologies, grid-connected and off-grid inverters, and related equipment)
- EKO MP-11 Portable I-V Curve Tracer
- Solar radiation measurement equipment: EKO MS-711 Spectroradiometer; EKO MS-80, Kipp & Zonen CM11, CM6B, and SpLite Pyranometers
- PVmet-500-M4 Meteorological Station
- Keithley 2412A SourceMeter Unit (SMU)
- National Instruments RMX-4005/RMX-4006 Programmable Electronic Load
- Campbell Scientific CR1000Xe Data Logger
- Solmetric SunEye 210 Shading Analysis Tool
- Six Siemens S7-1200 PLC Training and Development Kits

4. KEY PROJECTS AND REFERENCES

- Strategic Partnership for Green Energy – OptiNERG
- A System for Establishing a Stable Power Distribution Network – GridS
- Performance and Reliability of Photovoltaic Systems – Evaluations of Large-Scale Monitoring Data, COST Action PEARL PV (CA16235), 2017–2022

5. COLLABORATION OPPORTUNITIES

The group welcomes collaboration with industrial and research partners in the field of photovoltaic (PV) technologies and systems. The group's activities include experimental testing and characterization of solar cells, PV modules, and PV systems, analysis of their performance under real operating conditions, and investigation of losses, degradation mechanisms, and failures affecting system operation and reliability.

Possible areas of cooperation include PV system design, modelling, and optimization, performance analysis and energy yield assessment, diagnostics of existing installations, and development of monitoring and maintenance methods. Research topics for collaboration include novel PV materials and solar cell architectures, as well as new applications and integration concepts of PV technologies, such as agrivoltaic and floating PV systems.

The group is also open to collaboration on the development of customized electronic measurement and monitoring solutions for both research and industrial applications.

Possible forms of collaboration include joint research and development projects, consultancy studies and expert assessments, development and validation of new technologies, demonstration projects, and participation in national and international funding programmes.

6. CONTACT

Head of Research Group: Tihomir.Betti@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR COMPUTER VISION, INTELLIGENT SYSTEMS AND BIOSIGNALS (CVISBIS)

Head of the Group:

Mirjana Bonković

<https://www.croris.hr/osobe/profil/8584?lang=en>

Scientific Field:

Signal Processing / Electrical Engineering and Computer Science

Brief Description of the Research Group:

The research group is active in the fields of artificial intelligence, computer vision, biosignal processing, and the development of intelligent sensor systems. Its research focuses on advanced machine learning and deep learning methods for the analysis of image, video, and biosignal data, with applications in healthcare, robotics, agriculture, industry, maritime transport, and smart environments.

The group develops intelligent sensing and cyber-physical systems that integrate computer vision, Internet of Things (IoT) technologies, embedded systems, and advanced data analytics. Particular emphasis is placed on developing algorithms for edge devices, autonomous robotic platforms, and real-time decision-making systems.

Research activities include biosignal analysis, health assessment and rehabilitation monitoring, intelligent visual control systems, precision agriculture, 3D modelling and scene reconstruction, development of advanced Bayesian frameworks for risk analysis and surveillance system optimization, computer vision and sensor fusion for maritime applications, integration of augmented and virtual reality (AR/VR) into industrial processes, application of intelligent machine learning algorithms for behavioural prediction and interaction modelling in socio-technical systems, and the application of large language models (LLMs), vision-language models (VLMs), and generative artificial intelligence in intelligent information systems.

The group actively participates in national and international research projects and collaborates with academic institutions and industrial partners in developing innovative AI-based technologies.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Mirjana Bonković
- Mojmil Cecić
- Tamara Grujić
- Ana Kuzmanić Skelin
- Ivo Stančić

2. EXPERTISE AND KNOW-HOW

- Computer vision and image/video data analysis
- Machine learning and deep learning for classification, detection, segmentation, and prediction
- Development of intelligent sensing and measurement systems

- Biosignal processing and analysis and digital health technologies
- Wearable sensors and systems for monitoring physiological and rehabilitation parameters
- Multi-sensor data fusion and Internet of Things (IoT) systems
- Edge AI and deployment of AI algorithms on embedded platforms
- Autonomous robotic systems and vision-based control
- Precision agriculture and computer vision applications in agri-tech
- Analysis of imbalanced and heterogeneous datasets
- 3D modelling, reconstruction, and visualization
- Generative artificial intelligence, Large Language Models (LLMs), Vision-Language Models (VLMs), and intelligent agents
- Optoelectronic sensors and advanced data acquisition systems

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Modelling and Vision-Based Control
- Laboratory for Sensor and IoT Systems

4. KEY PROJECTS AND REFERENCES

- Integrated, Secure and Green Digital Platform for Continuous QA, Multi-channel Campaign Monitoring and AI Analytics in Digital Marketing – Marketing Operating System (mOS), IRI S3 Project, European Regional Development Fund (Project Leader: Kuzmanić)
- Establishment of the Regional Competence Centre for Electrical Engineering and Computer Science in Split-Dalmatia County, EU Project under the Operational Programme Effective Human Resources (Kuzmanić – Team Member)
- Competence Centre for Advanced Mobility – Development of an Innovative Ship Outfitting Process Using Augmented Reality (IRA 10), EU Project under the Operational Programme Competitiveness and Cohesion (Bonković and Kuzmanić – Project Leaders)
- Virtual CulTourist – Development of a User Interface for the Virtual Presentation of Cultural Heritage through the Integration of Innovative 3D Technologies, Split-Dalmatia County Innovation Programme (Kuzmanić and Bonković – Project Leaders)
- Advanced 3D Virtualization Methods – Towards Virtual Tourism and the Digitalization of Split's Cultural Heritage, Split-Dalmatia County Innovation Programme (Kuzmanić and Bonković)
- Croatian Science Foundation (HRZZ): Computer Vision for Olive Fruit Detection and Yield Estimation (CoViO) (Bonković – Team Member)
- SeaMate – AI-, LLM-, and IoT-Based Virtual Agent for Smart Nautical Management (Stančić – Team Member)
- National Competence Centres within the EuroHPC Framework – Phase 2 (Stančić – Coordinator)
- Development of Lightweight Polymer Vehicle Body Components for Improved Energy Efficiency (Stančić – Team Member)
- Croatian Science Foundation (HRZZ): Artificial Intelligence for Medical Devices (Stančić – Team Member)

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with industry, public sector organizations, and research institutions in the development of solutions based on artificial intelligence, computer vision, and intelligent sensor systems.

Areas of particular interest include:

- Process automation and industrial analytics
- Digital health and medical technologies
- Wearable sensing and user monitoring systems
- Precision agriculture and smart natural resource management
- Autonomous robotic and unmanned systems
- Big data processing and analytics
- Edge AI and IoT solutions
- Applications of generative artificial intelligence and large language models
- Development of technology prototypes and demonstrators
- Predictive modelling and risk assessment under uncertainty
- Evaluation and classification of large-scale datasets
- Multi-source sensor stream analysis
- Advanced 3D digitization and Digital Twins

The group provides support throughout the entire innovation cycle—from fundamental research and concept development to implementation, validation, and technology transfer to industry and end users.

6. CONTACT

Head of Research Group: mirjana.bonkovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR EDGE COMPUTING, IoT AND HIGH-PERFORMANCE COMPUTING

Head of the Group:

Prof. Sven Gotovac, PhD

<https://www.croris.hr/osobe/profil/16531?lang=en>

Scientific Field:

Technical Sciences / Electrical Engineering and Technical Sciences / Computer Science

Brief Description of the Research Group:

The research group specializes in the processing and analysis of data collected by remote sensors, unmanned aerial vehicles, and satellites, as well as their integration into GIS systems for risk modeling and assessment using high-performance computing. The group develops IoT sensors and communication systems based on LoRaWAN technology to support emergency services, as well as mobile sensor platforms equipped with RGB, thermal, and other sensors for edge data processing. In addition, the group focuses on the optimization and acceleration of computing applications using advanced hardware accelerators and graphics processing units (GPUs).

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Linda Vicković, PhD
- Prof. Stipo Čelar, PhD
- Assoc. Prof. Vladimir Pleština, PhD
- Assist. Prof. Dunja Božić-Štulić, PhD

Other faculty researchers:

- Ante Ivanović, MSc in Agricultural Engineering

2. EXPERTISE AND KNOW-HOW

- Processing of images from remote sensors (RGB, multispectral, LiDAR), unmanned aerial vehicles, and satellites; mapping onto GIS platforms; and development of various risk assessment models using HPC infrastructure.
- Development of IoT sensors and implementation of LoRaWAN systems with supporting software for monitoring emergency service personnel in the field.
- Development of mobile sensor systems based on RGB and thermal cameras and other sensors, with edge data processing using various technologies, including NVIDIA Jetson, Qualcomm RB5, and Qualcomm Snapdragon 865.
- Acceleration of applications at CERN using various hardware accelerators, primarily AMD graphics processing units (GPUs).

3. RESEARCH INFRASTRUCTURE

Laboratories

- B523 – Laboratory for computer architecture and operating systems

Equipment

- DJI Matrice 350 RTK H30T unmanned aerial vehicle

- P1 and L1 sensors with DJI Terra software

Advanced Computing Resources

- Server equipped with four graphics cards for training complex computer vision (CV) models
- Server equipped with an RTX 5090 graphics card
- Two servers equipped with A4000 and A2000 graphics cards
- Video wall consisting of six 55-inch LG 55VSM5J-H displays connected in a “Daisy Chain” configuration, with custom-developed software for content display

4. KEY PROJECTS AND REFERENCES

- Interreg HR-BA-ME: Establishing a Regional Innovation and Technology Transfer Ecosystem – ERIT
- Interreg HR-BA-ME: SmartProtect – Advanced Technologies for the Management of Natural and Human-Induced Disasters
- HORIZON: DARE – Deployment And Engagement of Resources and Citizens for European Emergency Response
- HRZZ IP-2024-05 CoViO: Computer Vision for Fruit Detection and Yield Assessment in Olive Production
- SPIN – Tehnet Smart Control: Development of an Intelligent Mobile System for Infrastructure Management and Monitoring
- CERN ALICE Computing

5. COLLABORATION OPPORTUNITIES

The research group is open to collaboration in the development of comprehensive systems for the acquisition, processing, analysis, and presentation of spatial and sensor data, tailored to the specific needs of end users.

Specific areas of collaboration include:

- Remote sensing and data acquisition using unmanned aerial vehicles (UAVs), satellite systems, RGB, thermal, multispectral, and LiDAR sensors, as well as distributed IoT sensor networks.
- Integration of heterogeneous data sources, including UAV, satellite, IoT, meteorological, and other spatial data.
- Online edge data processing (edge computing) for applications requiring data processing and decision-making in real or near-real time.
- Offline processing and analysis of large volumes of data using HPC infrastructure, graphics processing units (GPUs), computer vision, artificial intelligence, and advanced data processing algorithms.
- GIS integration, spatial analysis, modeling, and risk assessment based on collected and processed data.
- Development of user-oriented systems for visualization and presentation of results, including web, desktop, GIS, and video wall solutions.

Collaboration is possible with research institutions, public services, and industry, ranging from the development of demonstrators and pilot systems to the implementation of operational solutions.

6. CONTACT

Head of Research Group: Sven.Gotovac@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR DIGITAL SYSTEMS AND COMPUTER NETWORKS

Head of the Group:

Assoc. Prof. Ante Kristić, PhD

<https://www.croris.hr/osobe/profil/27609?lang=en>

Scientific Field:

Engineering / Electrical Engineering

Engineering / Computer Science

Brief Description of the Research Group:

The research group focuses on computer networks, wireless communications, digital system design, and data analysis. Its expertise includes the design of digital circuits implemented on programmable logic devices and application-specific integrated circuits (FPGA and ASIC), the development of real-time data processing systems, and the design of flow control and Quality of Service (QoS) algorithms for packet-switched networks. The group also applies machine learning methods for the analysis of complex datasets and contributes to the development of advanced detector systems for high-energy physics experiments, including the CMS High-Granularity Calorimeter (HGCAL).

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Duje Čoko, PhD
- Assoc. Prof. Ante Kristić, PhD
- Assist. Prof. Vesna Pekić, PhD
- Assist. Prof. Marina Prvan, PhD

Other faculty researchers:

- Sebastian Karl Mladen Haupt, MEng (Electrical Engineering)

2. EXPERTISE AND KNOW-HOW

- Digital logic design using programmable logic architectures (FPGA)
- Application-Specific Integrated Circuit (ASIC) design
- Machine learning-based data analysis
- Real-time data processing
- Flow control in packet-switched computer networks
- Quality of Service (QoS)
- MAC protocols for wireless communication networks
- CMS High-Granularity Calorimeter (HGCAL) upgrade

3. RESEARCH INFRASTRUCTURE

The research group has access to a wide range of programmable logic development platforms. These include educational Spartan Starter Kit boards, Nexys Video FPGA boards, adaptive System-on-Module platforms such as the Kria KV260, hybrid systems combining conventional

processors with programmable logic (PYNQ-Z1), and advanced FPGA platforms for instrumentation software development based on the Virtex UltraScale+ VCU118 device. In addition, the group operates a laboratory equipped with ten personal computers and holds licenses for professional software tools required for digital system design and implementation, including the Cadence ASIC design suite with TSMC technology libraries and the AMD/Xilinx Vivado Design Suite.

Laboratories

- B419, FESB

Equipment

- AMD Virtex™ UltraScale+™ FPGA VCU118 Evaluation Kit
- Nexys Video AMD Artix™-7 FPGA Board
- AMD Kria KV260 Vision AI Starter Kit
- PYNQ-Z1 Development Board
- Spartan-3E Starter Kit
- Cadence ASIC Design Suite
- AMD Vivado Design Suite

4. KEY PROJECTS AND REFERENCES

Members of the research group have participated as researchers or principal investigators in the following projects:

- CMS High-Granularity Calorimeter Upgrade (CMS-HGCAL)
- Beyond the Edge: FPGA- and AI-Based Systems for Time-Critical Applications
- DATACROSS – Advanced Methods and Technologies in Data Science and Cooperative Systems
- Control Systems for Photovoltaic Power Plants (SURFER)
- Internet of Things: Research and Applications

Four members of the research group have received the University of Split Recognition Award for their contribution to the University's development and international visibility.

The head of the research group is the inventor of the first patent granted by the United States Patent and Trademark Office (USPTO) with the University of Split and FESB as assignees: Devices Using Self-Adapting Medium Access Control Protocol (US Patent No. 10,165,597 B2).

5. COLLABORATION OPPORTUNITIES

Based on the expertise of its members, the research group welcomes collaboration with academic researchers and industry partners in the following areas:

- Real-time data processing
- Development of hardware and algorithms for real-time data processing
- Machine learning-based data processing algorithms
- Big data processing and analytics
- Design and evaluation of communication protocols

6. CONTACT

Head of Research Group: Ante.Kristic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ADVANCED NETWORK TECHNOLOGIES AND SYSTEMS (NMTS)

Head of the Group:

Prof. Josip Lörincz , PhD

<https://www.croris.hr/osobe/profil/156?lang=en>

Scientific Field:

Engineering Sciences / Electrical Engineering / Computer Science

Brief Description of the Research Group:

The research group focuses on the analysis and development of advanced Information and Communication Technologies (ICT), with particular emphasis on networking, wireless and optical systems, sensor networks, Internet of Things (IoT) technologies, and mobile and satellite communications. The group's expertise encompasses information and signal processing in telecommunications, energy-efficient ICT systems and networks, machine learning applications, network and system security, as well as the development of communication software and network-based services. Research activities cover energy-efficient ICT infrastructures, secure communication systems, positioning and synchronization in communication networks, wireless sensor and IoT networks, data transmission and processing systems, and emerging paradigms such as cognitive networking, software-defined networking (SDN), network function virtualization (NFV), cloud computing for data centres, and virtual reality systems.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Dinko Begušić, PhD
- Prof. Mario Čagalj, PhD
- Prof. Josip Lörincz, PhD

Other faculty researchers:

- Katarina Radoš, PhD
- Mislav Kovač, MSc in Engineering

2. EXPERTISE AND KNOW-HOW

- ICT networking technologies
- Wireless networks
- Optical networks
- Internet of Things (IoT)
- Mobile Internet
- Information processing
- Digital signal processing
- Machine learning methods
- Network and system security
- Communication software
- Energy-efficient ICT technologies and systems

- Positioning in wireless networks
- Wireless sensor networks
- Synchronization in communication networks
- Development of network-based services
- Quality of Service (QoS) in communication networks
- Virtual reality systems
- Cognitive networks
- Software-defined networking (SDN)
- Network function virtualization (NFV)
- Cloud computing
- Satellite communication systems and GNSS technologies
- Energy certification of networks, systems, and buildings

3. RESEARCH INFRASTRUCTURE

Laboratories

- Advanced Network Technologies Laboratory
- Network and System Security Laboratory
- Digital Signal Processing Laboratory

Equipment

- Optical Time-Domain Reflectometer (EXFO OTDR Platform FTB-200/FTB-500 with OTDR modules)
- Digital oscilloscope up to 2.5 GHz (Tektronix DPO 7254)
- Vector signal generator (Agilent EXG N5172B series)
- USRP N310 Software-Defined Radio (SDR) platform
- Communication equipment (routers, switches, access points, WLAN controllers)
- LoRa sensor devices and LoRa gateways
- Uninterruptible Power Supply (UPS) systems

Advanced Computing Resources

- Data server infrastructure

4. KEY PROJECTS AND REFERENCES

- Detection of Jamming and Spoofing in Global Navigation Satellite Systems (GNSS) (Ericsson Nikola Tesla d.o.o.)
- Data-Driven Artificial Intelligence Models for Energy-Efficient 5G Radio Resource Allocation – 5gENERGYOPT (Ericsson Nikola Tesla d.o.o.)
- Data Reliability in IoT Sensor Networks – DR_IoT-SN (Ericsson Nikola Tesla d.o.o.)
- Establish Pan-European Information Space to Enhance Security of Citizens (EPISECC) (EU FP7)
- Green Networking (Croatian Science Foundation – HRZZ)

5. COLLABORATION OPPORTUNITIES

The group is interested in collaborating on research, development, consultancy studies, technical analyses, expert assessments, and feasibility studies in the areas of telecommunications, cybersecurity, communication systems, wired and wireless local, access, and core networks, energy-efficient ICT systems and networks, sensor and IoT networks, data centres, software architectures and solutions, as well as energy certification and auditing. The

group welcomes collaboration with ICT companies and software developers, public authorities, municipalities, counties, government agencies, ministries, institutes, universities, faculties, and research organisations. Cooperation can be established through local, regional, national, and international educational, professional, and research projects, including projects funded through major European programmes such as:

- Horizon Europe (European Research Council – ERC, Marie Skłodowska-Curie Actions – MSCA, European Innovation Council – EIC, Digital Europe Programme, COST, Research Infrastructures, Joint Research Centre – JRC, European Innovation Ecosystems – EIE, European Institute of Innovation and Technology – EIT, EU Missions, European Partnerships, Widening Participation)
- European Regional Development Fund (ERDF), Cohesion Fund (CF), Just Transition Fund (JTF)
- Climate, Energy and Environment (LIFE Programme, Innovation Fund, Connecting Europe Facility (CEF))
- Education (Erasmus+)
- Health, Agriculture and Maritime Sectors (EU4Health, European Agricultural Fund for Rural Development (EAFRD), European Agricultural Guarantee Fund (EAGF), European Maritime, Fisheries and Aquaculture Fund (EMFAF)
- Security and Defence (European Defence Fund (EDF), Internal Security Fund (ISF))

6. CONTACT

Head of Research Group: Josip.Lorincz@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR COMPUTATIONAL INTELLIGENCE FOR HUMAN ACTIVITY RECOGNITION AND ASSISTANCE (RIPrePAkt)

Head of the Group:
Prof. Vladan Papić, PhD

<https://www.croris.hr/osobe/profil/4493?lang=en>

Scientific Fields:
Engineering Sciences / Electrical Engineering
Engineering Sciences / Computer Science

Brief Description of the Research Group:

The research group focuses on the development of intelligent systems that integrate robotics, machine learning, and advanced control methods. Its expertise includes object detection and tracking, human-machine interaction, and the control and optimization of complex systems. The group also investigates biomechanical processes and their application in the development of innovative technologies. In addition, it develops solutions in the fields of virtual and augmented reality aimed at enhancing user experience, supporting data analysis, and improving decision-making processes.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Josip Musić, PhD
- Assoc. Prof. Tea Marasović, PhD
- Assist. Prof. Stanko Kružić, PhD

Other faculty researchers:

- Toma Sikora, Research Assistant
- Ana Šarić Gudelj, Research Assistant

2. EXPERTISE AND KNOW-HOW

- Object detection and tracking
- Robotics
- Human-machine interaction
- Control systems and optimization
- Machine learning
- Biomechanics
- Remote sensing and IoT applications in agriculture

3. RESEARCH INFRASTRUCTURE

Laboratories

- Biomechanics, Automation and Systems Laboratory

- Expert Systems, Machine Learning and Image Processing Laboratory

Equipment

- Various biomechanical measurement systems, including force platforms, EMG systems, and Xsens inertial sensors, Image acquisition equipment, including camcorders, 3D cameras, and high-speed cameras
- Signal acquisition devices such as Microsoft HoloLens 2, sensor gloves, accelerometers, and Kinect systems
- Unmanned aerial vehicles (UAVs) equipped with RGB, multispectral, and thermal cameras
- Mobile robotic platforms (BlueROV2, Leo Rover, Mover6, M5ver 5)
- Educational and research robotics kits (Arduino, LEGO Mindstorms NXT, TurtleBot)

4. KEY PROJECTS AND REFERENCES

- HRZZ IP-2024-05-6393 – Computer Vision for Olive Fruit Detection and Yield Estimation (CoViO), Principal Investigator: V. Papić
- HR-BA-ME00392 – Advanced Technologies for Natural and Human-Induced Disaster Management (SmartProtect), Interreg Project
- HR-BA-ME00522 – Establishing a Regional Innovation and Technology Transfer Ecosystem (ERIT), Interreg Project, Principal Investigator: V. Papić
- IP-UNIST-10 – AI-Driven Solutions for Field Exploration and Disaster Response: Autonomous Drones, Robotics and Human Well-Being (UITOK), Institutional Research Project, Principal Investigator: V. Papić
- Tehnet Smart Control – Development of an Intelligent Mobile System for Infrastructure Management and Monitoring, SPIN Project

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration in professional and scientific research projects related to the areas listed under its expertise and know-how. Particular interest is directed toward the application of robotics in Industry 5.0, the use of artificial intelligence for processing and analysing diverse types of data, and the development of digital agriculture applications and solutions.

6. CONTACT

Head of Research Group: Vladan.Papic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR SMART IoT TECHNOLOGIES AND INTELLIGENT SYSTEMS (PIoTIS)

Head of the Group:

Prof. Toni Perković, PhD

<https://www.croris.hr/osobe/profil/27583?lang=en>

Scientific Field:

Engineering Sciences / Electrical Engineering and Computing (including Signal Processing and Computer Vision)

Brief Description of the Research Group:

The research group brings together expertise in smart IoT environments, digital health, and computer vision/artificial intelligence. It develops innovative solutions integrating the Internet of Things, wireless and networking technologies, signal processing, machine learning, deep learning, and computer vision, with applications in smart cities, Industry 4.0, eHealth, and intelligent sensor systems. The group collaborates on national and EU-funded research projects (Croatian Science Foundation – HRZZ, IRI, EuroHPC), develops prototypes for industrial and public-sector partners, and combines expertise in networking technologies, cybersecurity, biosignal processing, high-performance computing, and Edge AI into a multidisciplinary research environment.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Toni Perković, PhD
- Prof. Petar Šolić, PhD
- Assoc. Prof. Ivo Stančić, PhD
- Prof. Maja Štula, PhD
- Prof. Joško Radić, PhD

Other faculty researchers:

- Josip Šabić
- Marija Zorić
- Marijan Šimundić-Bendić
- Marijana Čular
- Luka Kranjac
- Ana Terzić
- Anamarija Mamić
- Ivan Čaleta

2. EXPERTISE AND KNOW-HOW

- Networking Technologies
- Wireless Networks

- Internet of Things (IoT)
- Machine Learning
- Mobile Internet
- Signal Processing
- Network and System Security
- Computer Forensics
- Wireless Sensor Networks
- Communication Systems
- Data Analytics
- Deep Learning
- Cloud Computing
- High-Performance Computing (HPC)
- Bioinformatics
- eHealth
- Software Development
- Computer Vision
- Edge AI and Embedded Systems
- Autonomous Robotic Systems

3. RESEARCH INFRASTRUCTURE

Laboratories

- RFID Technology Laboratory
- IoT Laboratory
- Sensor IoT Systems Laboratory

Equipment

- HF and UHF RFID readers
- HF and UHF signal generators
- Spectrum analyzer and Software-Defined Radio (SDR) systems
- Digital oscilloscope
- Arduino-based sensor systems
- LPWAN-based systems (LoRaWAN, NB-IoT, Sigfox)
- 3D printing equipment and printed circuit board (PCB) fabrication system
- NVIDIA T1000 GPU for developing deep learning models using diverse data sources
- NVIDIA Quadro RTX A5000 (24 GB)
- EEG device
- Indoor air quality sensors

Advanced Computing Resources

- The group participates in the National Competence Centre for HPC/AI within the EuroCC2 (EuroHPC) project, providing access to advanced high-performance computing and AI infrastructure.

4. KEY PROJECTS AND REFERENCES

- SeaMate – AI-, LLM-, and IoT analytics-based virtual assistant for smart nautical management
- Verification of Information Accuracy in the Fields of Energy and Computing
- Digitalisation of the Civil Protection Plan through an IoT-Based Decision Support Platform
- National Competence Centres in the Framework of EuroHPC Phase 2
- SmartRideAI – Intelligent Systems for Safe and Sustainable Mobility

5. COLLABORATION OPPORTUNITIES

The group is open to collaboration with industry, the public sector, and research institutions in the development of solutions based on IoT technologies, artificial intelligence, and computer vision. Areas of particular interest include smart cities and smart buildings; digital health and wearable sensor systems; Industry 4.0 and the automation of manufacturing processes; cybersecurity and computer forensics; Edge AI and the deployment of algorithms on embedded and autonomous systems; high-performance computing (HPC) and access to HPC/AI infrastructure; as well as prototype development and digital transformation for industrial and public-sector partners. The group provides support throughout the entire innovation process—from research and concept development to implementation, validation, and technology transfer to end users.

6. CONTACT

Head of Research Group: Toni.Perkovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ELECTROMAGNETIC COMPATIBILITY AND NUMERICAL METHODS IN ELECTRONICS (MULTIMOD)

Head of the Group:

Prof. Dragan Poljak, PhD

<https://www.croris.hr/osobe/profil/9780?lang=en>

Scientific Fields:

Engineering Sciences – Electrical Engineering

Brief Description of the Research Group:

The research activities of the MULTIMOD group focus on advanced numerical modelling and experimental methods for the analysis of complex multiphysics engineering problems. The group develops theoretical formulations together with analytical and numerical solution methods in several interdisciplinary research areas, including bioelectromagnetics, electromagnetic-thermal dosimetry (with a particular emphasis on 5G systems), biomedical applications of electromagnetic fields, ground-penetrating radar, plasma physics, fusion technologies, space technologies, accelerator systems, wireless power transfer, electromagnetic compatibility, and stochastic processes in advanced communication networks.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Zoran Blažević, PhD
- Prof. Silvestar Šesnić, PhD
- Prof. Tonko Garma, PhD
- Assoc. Prof. Dr. Vicko Dorić
- Assoc. Prof. Dr. Mario Cvetković
- Assoc. Prof. Dr. Maja Škiljo
- Assist. Prof. Dr. Antonio Šunjerga
- Assist. Prof. Dr. Anna Šušnjara Nejašmić

Other faculty researchers:

- Dr. Klementina Vidjak

2. EXPERTISE AND KNOW-HOW

- Electromagnetic field theory
- Numerical methods in engineering
- Deterministic and stochastic modelling of multiphysics problems
- Electromagnetic compatibility (EMC), antennas and propagation, grounding systems, and ground-penetrating radar
- Human exposure to electromagnetic radiation and electromagnetic-thermal dosimetry
- Biomedical applications of electromagnetic fields
- Plasma physics

- Thermonuclear fusion and tokamak plasma equilibrium
- Neutron beam analysis in accelerator systems
- Stochastic electromagnetics, uncertainty quantification, and sensitivity analysis

3. RESEARCH INFRASTRUCTURE

Laboratories

- Radio Propagation Laboratory
The laboratory conducts measurements of RF devices, antennas, and radio-wave propagation. It is equipped with computers, oscilloscopes, function generators, EMC probes, spectrum analyzers, signal generators, Tesla coils, a ground-penetrating radar prototype, and a variety of antenna systems.
- Numerical Methods Laboratory
The laboratory includes six workstations and a high-performance computing workstation equipped with a dedicated GPU for advanced numerical simulations.

Equipment

- Anritsu Spectrum Analyzer MS2711E, operating from 9 kHz to 3 GHz, with a dynamic range exceeding 85 dB (at 100 Hz RBW)
- Anritsu Vector Network Analyzer MS2026C, dual-port configuration, operating from 9 kHz to 6 GHz

4. KEY PROJECTS AND REFERENCES

- Human Exposure to Radiation from new Wireless Communication Technologies using Advanced Electromagnetic-Thermal Dosimetry Models (HERWICT) – Slovenian-Croatian Project (HRZZ)
- IFMIF DONES: WPENS AS (Accelerator Systems) - Sensitivity analysis of the uncertainty propagation in static and dynamic simulations of neutron flux within Test Cell, (EUROfusion)
- IFMIF DONES: WPENS PI (Project Integration) - EMI/EMC Analysis of Electric and Electronic Equipment in IFMIF-DONES, (EUROfusion)
- Simulation and Protective Design of Electromagnetic Radiation in Offshore Wind Power Based on Semi-Analytical Methods (Croatian-Chinese bilateral project)
- Research on Intelligent Operation and Maintenance Strategies for Wind Power Equipment with Low Electromagnetic and Noise Pollution (Croatian-Chinese bilateral project)

5. COLLABORATION OPPORTUNITIES

- Multidisciplinary research in multiphysics, plasma physics, and environmental physics
- Integration of conventional deterministic-stochastic computational models with artificial intelligence (AI), digital twins, machine learning (ML), and physics-informed neural networks (PINNs), including the development of efficient surrogate models

- Multidisciplinary research in bioelectromagnetics, environmental protection from unwanted electromagnetic exposure, and the development of biomedical devices such as biosensors, transcranial magnetic stimulation (TMS), transcranial electrical stimulation (TES), and neurostimulation systems (TENS and PENS)
- Assessment and measurement of non-ionizing radiation sources and their environmental impact, including applications in national and international standardization, development of specialized software, expert consulting, and optimization of service quality and safety aspects of 5G and 6G mobile communication systems
- Studies of electromagnetic compatibility, antenna systems, grounding systems, ground-penetrating radar, and cylindrical waveguides, with applications in air traffic management and maritime communication systems
- Analysis and optimization of wireless power transfer systems
- Measurement and environmental impact assessment of non-ionizing radiation sources
- Thermal performance assessment and heating analysis of power cables

6. CONTACT

Head of Research Group: dragan.poljak@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ADVANCED TECHNOLOGIES IN SMART ENVIRONMENTS (NTPO)

Head of the Group:

Prof. Mladen Russo, PhD

<https://www.croris.hr/osobe/profil/2356?lang=en>

Scientific Field:

Engineering Sciences / Electrical Engineering and Computing

Brief Description of the Research Group:

The Research Group for Advanced Technologies for Smart Environments develops intelligent solutions based on artificial intelligence, machine learning, the Internet of Things (IoT), and modern communication technologies. Its core areas of expertise include virtual and augmented reality, telemedicine, wearable interfaces, computer vision, multimedia systems, wireless sensor networks, positioning technologies, and geographic information systems. The group conducts research focused on the development of smart environments for healthcare, industry, education, and smart cities, with a strong emphasis on innovation, digital transformation, and the transfer of knowledge into practical applications.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Matko Šarić, PhD
- Prof. Marjan Sikora, PhD
- Prof. Maja Stella, PhD

Other faculty researchers:

- Luka Kraljević, PhD
- Jurica Đerek, PhD
- Davor Meter, MEng

2. EXPERTISE AND KNOW-HOW

- Machine Learning and Artificial Intelligence
- Virtual and Augmented Reality
- Telemedicine
- Wearable Interfaces and Emotion Recognition
- Communication and Information Technologies
- Multimedia Systems and Networks
- Object and Speech Recognition
- Wireless Sensor Networks
- Positioning in Wireless Networks
- Geographic Information Systems (GIS)
- Soundscapes and Auralization

3. RESEARCH INFRASTRUCTURE

Laboratories

- Smart Environment Technologies Research Laboratory
- Multimedia Systems and Virtual Reality Laboratory
- Electroacoustics Laboratory
- Communication and Information Systems Laboratory
- IP Technologies and Communication Protocols Laboratory
- Digital Television and Video Laboratory

Equipment

- Anechoic Chamber
- Microphones, Audio Amplifiers, USB Audio Interfaces, Active and Passive Loudspeakers
- Virtual and Augmented Reality Headsets
- Motion Tracking Sensor Glove
- 3D Monitor
- Skin Conductance, Electrocardiogram (ECG), and Motion Tracking Measurement Kit
- EEG Recording System
- 3D Printer
- Tetramic Spatial Microphones
- CAVE Virtual Reality System
- Spectrum Analyzer, Oscilloscope, and Signal Generators

4. KEY PROJECTS AND REFERENCES

- EXCEED – Capacity Building for Excellence in Digital Health Research (2025–present), DIGIT
- FIRELOC – Sound Event Recognition and Localization from Few-Shot Examples (2025–present), Ministry of Science, Education and Youth of Croatia (MSEY) and MOST China
- SENSE – EEG-Based Emotion Recognition System for Children with Autism Spectrum Disorder (2024–2025), National Recovery and Resilience Plan (NRRP)
- VITA – Virtual Telemedicine Assistance (2021–2023), EU Funds
- ELISE – Easy Living in Smart Environments (2015–2018), Croatian Science Foundation (HRZZ)

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with academic institutions, healthcare organizations, industry partners, and public-sector stakeholders in the development of smart and digital solutions. Particular interest is focused on the application of artificial intelligence, computer vision, virtual and augmented reality, telemedicine, and communication technologies in healthcare, education, industry, and smart cities.

The group has extensive experience in the development of prototypes, experimental systems, and multidisciplinary research projects. It is actively interested in joint national and international projects, technology transfer activities, the development of innovative products and services, and collaboration within Horizon Europe, Interreg, and other research and innovation programmes.

Potential forms of collaboration include joint research projects, development of demonstration and pilot solutions, expert consulting services, training and education activities, researcher exchange programmes, and access to laboratory infrastructure.

6. CONTACT

Head of Research Group: mrusso@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR APPLIED ELECTROMAGNETICS AND RF ELECTRONICS

Head of the Group:

Prof. Antonio Šarolić, PhD

<https://www.croris.hr/osobe/profil/4832?lang=en>

Scientific Field:

Engineering Sciences / Electrical Engineering

Brief Description of the Research Group:

The research group is active in the fields of applied electromagnetics and radio-frequency (RF) electronics. The group conducts research and teaches the courses (within FESB study programmes) in wireless communications, antennas, antenna systems and technologies, RF and microwave engineering, electronics and electronic circuits, electromagnetic measurements, and electromagnetic compatibility (EMC). The Department also possesses specialized expertise in maritime and military communication systems. The group's research and teaching activities are also strongly focused on the application of electromagnetics, electronics, and engineering in biomedicine. The Department covers research and education in bioelectromagnetics, medical devices, biomedical applications, and the biological effects of electromagnetic fields. The group has extensive experience in carrying out professional projects, as well as preparing technical studies, expert reports, and consultancy services for industry and other external stakeholders.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Antonio Šarolić, PhD
- Prof. Ivan Marinović, PhD

Other faculty researchers

- Dominik Žanić, PhD, Senior Teaching and Research Assistant
- Viktoria Pavlovski, MEng in Electrical Engineering
- Matea Paradžik, MEng in Electrical Engineering

2. EXPERTISE AND KNOW-HOW

- Electromagnetic simulations and electromagnetic measurements
- Antenna design, fabrication, and simulation-based analysis
- Antenna parameter measurements and antenna calibration
- Design, development, and analysis of electronic, RF, and microwave components and circuits
- Electromagnetic compatibility (EMC) analysis
- Measurement of dielectric properties of materials, including biological tissues
- Electromagnetic field measurements and human EMF exposure assessment
- Medical device development in collaboration with biomedical and biological experts
- Research in bioelectromagnetics and electrical stimulation

3. RESEARCH INFRASTRUCTURE

Laboratories

- Department of Applied Electromagnetic Fields and RF Electronics Laboratories:
 - Laboratory for Electromagnetic Research and Testing (EMLAB)
 - Laboratory for Electronic Circuits and Applied Electronics

Equipment

- TESEQ GTEM 750 chamber for generating standardized electromagnetic fields
- Helmholtz coils for generating standardized magnetic fields
- Parallel-plate system for generating standardized electric fields
- Signal generators, oscilloscopes, analyzers, amplifiers, sensors, and antennas
- Keysight FieldFox N9927A Vector Network Analyzer
- Electromagnetic simulation software packages
- Measurement instruments and probes for dielectric characterization of biological tissues and other materials
- Measurement instruments and probes for electromagnetic field measurements
- PCB prototyping and planar structure fabrication equipment

4. KEY PROJECTS AND REFERENCES

Research Projects

- COST EMF-MED (Action BM1309): European Network for Innovative Uses of EMFs in Biomedical Applications (2014–2018); European project leader: Antonio Šarolić
- HRZZ EMF-Med: Electromagnetic Characterization of Biological Tissues and Cells for Medical and Biological Applications (2024–2027); Principal Investigator: Antonio Šarolić
- NAVIS MARINE Digital Platform (2025–2028); Head of the FESB research component: Antonio Šarolić
- Scientific Excellence for Societal Challenges: Intelligent Models and Interfaces for Safety and Health (ZIDI): Institutional research project; leader of the work package focused on the development of biomedical models for diagnostic devices: Antonio Šarolić
- Measurements in Bioelectromagnetics (M-BEM): Institutional research project; Principal Investigator: Antonio Šarolić

Professional Projects

- Studies on the impact of non-ionizing electromagnetic radiation at Croatian Navy (HRM) and Ministry of Defence (MORH) military sites
- Electromagnetic compatibility studies of wind farms with military and civil radar systems
- Consultancy for the development of an implantable electrical stimulation device (NUIG, Ireland)
- Consultancy for the development of an electromagnetic field measurement probe (WaveControl, Spain)
- Technical inspections of radio stations

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration in the fields of electromagnetic simulations, measurements, and the development of RF, microwave, and antenna systems, as well as in addressing electromagnetic compatibility (EMC) challenges and assessing human exposure to electromagnetic fields. We are particularly interested in collaborating with academic institutions, industrial partners, and public-sector organizations on projects involving the design and testing of antennas, electronic and measurement systems, dielectric characterization of materials and biological tissues, and the development and validation of medical devices.

The group also provides support in the preparation of technical studies, expert reports, and professional analyses related to non-ionizing radiation, bioelectromagnetics, communication systems, and electromagnetic compatibility. Supported by well-equipped laboratory infrastructure and extensive experience in scientific research and industry-oriented projects, the group is well positioned to engage in collaborative research, development, consultancy, and educational activities.

6. CONTACT

Head of Research Group: antonio.sarolic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR INTELLIGENT SYSTEMS

Head of the Group:

Prof. Ljiljana Šerić, PhD

<https://www.croris.hr/osobe/profil/12036?lang=en>

Scientific Field:

Technical Sciences / Computer Science

Brief Description of the Research Group:

The Intelligent Systems Research Group focuses on the development of advanced artificial intelligence, generative AI, and data analytics methods for solving complex real-world problems across a wide range of application domains. Its core expertise includes intelligent systems, machine learning and deep learning, large language models (LLMs) and generative AI with Retrieval-Augmented Generation (RAG) architectures, agent-based and multi-agent systems, real-time AI agent orchestration, computer vision, image processing and understanding, natural language processing, semantic technologies, operational research, and optimization. The group develops innovative AI-driven solutions for remote sensing applications, including optical and radar satellite image analysis, advanced GIS technologies, digital twins, environmental protection, and the management of complex systems. These solutions are applied in wildfire prevention and response, marine protection and the blue economy, tourism, healthcare, and intelligent document management. Research activities are supported by high-performance computing (HPC), cloud and edge computing technologies, and close collaboration with national and international research partners.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assist. Prof. Antonia Ivanda, PhD
- Assist. Prof. Maja Braović, PhD
- Assoc. Prof. Marin Bugarić, PhD
- Prof. Damir Krstinić, PhD

Other faculty researchers:

- Professor Emeritus Darko Stipaničev, PhD
- Antonia Bartulović, Master of Computing; mag. ing. com
- Nataša Vulević, Master of Computing; mag. ing. com
- Mateo Radić, Master of Computing; mag. ing. com

2. EXPERTISE AND KNOW-HOW

- Intelligent systems
- Machine learning and deep learning
- Semantic technologies
- Cognitive vision
- Advanced image processing, analysis, and understanding

- Advanced Internet technologies
- Cloud and edge computing
- Advanced GIS technologies
- Modelling and management of complex systems
- Application of ICT and intelligent technologies in environmental protection, particularly wildfire prevention and management
- Digital twins for simulation and risk management
- Artificial intelligence for remote sensing, including optical and Synthetic Aperture Radar (SAR) satellite image analysis, classification, change detection, and sensor fusion
- Natural language processing and large language models (LLMs)
- Agent-based and multi-agent systems, agentic AI
- Real-time orchestration and coordination of AI agents
- Generative AI and Retrieval-Augmented Generation (RAG)
- Development of domain-specific and multilingual AI platforms for small and medium-sized enterprises (SMEs)
- Personalisation and recommendation systems
- Operations research and optimisation, including the generation and evaluation of alternative Courses of Action (CoA) and real-time decision support

3. RESEARCH INFRASTRUCTURE

Laboratories

- CIPOP – Centre for Wildfire Research
- LaIS – Laboratory for Intelligent Systems and Artificial Perception
- LaADIA – Laboratory for Advanced Digital Image Analysis
- LaANLA – Laboratory for Advanced Natural Language Analysis

4. KEY PROJECTS AND REFERENCES

- COST Action – european Network on Extreme fiRe behaviOr (NERO)
- FirEURisk – Developing a holistic, risk-wise strategy for European wildfire Management
- FireDT – Wildfire Digital Twin: Operational Risk Assessment and Recommendation System for Split-Dalmatia County
- HospitalityInSky & HealthInSky - Research and development of two innovative AI platforms (IRI S3 Programme)
- Development of Innovative AI Agents for Intelligent Digital Document and Signature Management as an Upgrade to the Doctavian Cloud DMS Platform (IRI S3 Programme)

5. COLLABORATION OPPORTUNITIES

The group actively collaborates with academic institutions, public-sector organisations, and industry partners in the following areas:

- Digital Twins and Environmental Technologies – Simulation and risk management for wildfires and climate-related extreme events, GIS analytics and AI-based analysis of optical and radar satellite imagery (e.g., Sentinel and NISAR missions), Marine protection and blue economy applications

- Generative and Agentic AI– Solutions based on large language models (LLMs) and RAG architectures, AI agents and orchestration frameworks for coordinating multiple agents in real time, Personalised and hybrid human–AI collaboration systems for tourism, healthcare, and document management
- Computer Vision and HPC/Edge Computing - Intelligent recognition, monitoring, and surveillance systems, Support for the adoption and utilisation of cloud, edge, and high-performance computing infrastructures
- Intelligent Decision Support - Generation, evaluation, and optimisation of operational plans (Courses of Action), Decision-support systems for emergency and crisis management

6. CONTACT

Head of Research Group: Ljiljana.Seric@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR THE DEPARTMENT OF PHYSICS (ASTROHEP)

Head of the Group:

Assoc. Prof. Damir Lelas, PhD

<https://www.croris.hr/osobe/profil/27649?lang=en>

Scientific Fields:

Natural Sciences/Physics

Brief Description of the Research Group:

The research group operates in the fields of experimental and theoretical particle physics and astrophysics, participating in the international CMS collaboration at CERN, as well as the MAGIC and CTA-LST collaborations. Research activities include measurements of the properties of the Higgs boson, searches for new physics and leptoquarks, the development and maintenance of advanced detector systems, and the study of sources of very-high-energy cosmic rays. In theoretical physics, the group develops models of physics beyond the Standard Model, including Grand Unified Theories, proton decay, and the flavor dynamics of quarks and leptons.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Ivica Puljak, PhD

Other faculty researchers:

- Ana Šćulac, MSc in Engineering
- Toni Šarić, MSc in Physics
- Mijo Matković, MSc in Physics
- Ivica Sorić
- Luka Palada, PhD

2. EXPERTISE AND KNOW-HOW

- Particle Physics – CMS group
- Astrophysics – MAGIC and CTA-LST groups
- Theoretical Particle and Field Physics

Research in experimental particle physics and very-high-energy gamma-ray physics is conducted within the CMS collaboration at CERN (<http://cms.web.cern.ch/>), the MAGIC collaboration (<http://magic.mppmu.mpg.de/>), and the CTA collaboration (<https://www.cta-observatory.org/>) within the working group building the Large Size Telescope (LST) (<http://www.lst1.iac.es/>).

Members of the CMS collaboration are actively involved in measuring the properties of the Higgs boson, studying aspects of left-right (LR) symmetric theories of electroweak interactions, and searching for leptoquarks at the Large Hadron Collider (LHC). In addition to direct research activities, the group is involved in the operation and development of the electromagnetic calorimeter of the CMS detector, as well as the HGCAL project, which is aimed at developing the future forward calorimeter of CMS.

The group's activities within the MAGIC collaboration are related to data quality assessment for the MAGIC telescopes and the search for Galactic sources of the highest-energy cosmic rays (PeV). This is enabled by the detection of gamma rays with energies above 100 TeV through the development of observation techniques at large zenith angles.

Within the CTA consortium, we participate in the working group responsible for building the largest telescope, the Large Size Telescope (LST). Our group is responsible for the design, construction, commissioning, and maintenance of systems for precise measurement, calibration, and correction of the telescope's pointing.

Theoretical research in particle and field physics focuses on aspects of leptoquark production and measurement at the LHC, proton decay phenomenology, Grand Unified Theories, and the flavor dynamics of quarks and leptons.

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Photodetector Characterization

Equipment

- Computer-controlled temperature chamber
- Keithley 6485 picoammeter
- Keithley 6487 voltage source/picoammeter
- Keithley 2000 multimeter
- CAEN N478 programmable power supply
- CAEN silicon photomultiplier package
- Equipment for testing and precision calibration
- Two CCD cameras with partially overlapping fields of view (for the needs of the CTA consortium, specifically the LST working group)

4. KEY PROJECTS AND REFERENCES

- ZCI ACROSS–DataScience – Centre of Excellence for Data Science and Cooperative Systems, 2015–2023; project leaders S. Lončarić and I. Petrović; researchers N. Godinović, D. Lelas, T. Šarić, A. Šćulac.
- Very High Energy Gamma-Ray Astronomy with MAGIC and CTA Telescopes, 2017–2021; Croatian Science Foundation (HrZZ) project; project leader N. Godinović; collaborator D. Lelas.
- Measurement of the Properties of the Higgs Boson and Search for New Physics with the CMS Detector, 2014–2018; Croatian Science Foundation (HrZZ) project; project leader I. Puljak; collaborators I. Doršner, N. Godinović, D. Lelas.
- Very High Energy Gamma-Ray Astronomy with the MAGIC Telescopes, 2012–2016; Croatian Science Foundation (HrZZ) project; project leader N. Godinović; collaborator D. Lelas.
- Search for the Higgs Boson and New Physics with the CMS Detector, 2007–2013; Ministry of Science, Education and Sports (MZOŠ) project No. 023-0982887-3064; project leader I. Puljak; collaborators N. Godinović and D. Lelas.

5. COLLABORATION OPPORTUNITIES

The ASTROHEP research group offers broad opportunities for collaboration through joint scientific research projects, technology transfer, and expert consulting in the following key areas:

- **Experimental Physics and Data Analysis:** Collaboration on the processing of large datasets (Data Science), analysis of physical processes within the CERN-CMS collaboration, and astrophysical measurements of the highest-energy gamma rays (MAGIC/CTA).
- **Detector Systems Development:** Joint work on the design, construction, integration, and maintenance of advanced calorimetric and optical systems for precision measurements.
- **Theoretical Modeling:** Development and phenomenological testing of theoretical models beyond the Standard Model, including flavor physics, Grand Unified Theories (GUT), and simulations of particle production and decay at the LHC.
- **Photodetector Characterization:** Use of specialized laboratory infrastructure for precise current-voltage characterization of silicon photomultipliers (SiPMs) and optical calibration in a computer-controlled temperature chamber.
- **Interdisciplinary Projects:** Combining expertise in particle physics with advanced computing (HPC/AI) and with industrial partners interested in high-tech equipment development.

6. CONTACT

Head of Research Group: Damir.Lelas@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR MATHEMATICAL RESEARCH (VISTAE)

Head of the Group:

Prof. Anita Matković, PhD

<https://www.croris.hr/osobe/profil/9737?lang=en>

Scientific Fields:

Natural Sciences / Mathematics

Brief Description of the Research Group:

The research group develops new theoretical and applied knowledge in the fields of mathematics, statistics, and information systems. Its activities focus on advancing mathematical inequalities and integral formulas for convex functions, investigating topological spaces through rough shape and finite rough shape theory, and developing the corresponding invariants. The group also applies advanced statistical methods to assess future extreme precipitation events and develops and validates extended technology acceptance models that incorporate organizational factors, user knowledge, and intelligent system features. In addition, the group conducts research in mathematics education, with a particular emphasis on diagnosing students' misconceptions of key concepts and developing modern teaching methodologies.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Josipa Barić, PhD
- Assist. Prof. Ivančica Mirošević, PhD

Other faculty researchers:

- Marina Dajaković, PhD, Senior Assistant
- Ivana Grgić, Senior Lecturer
- Dajana Dujić, Lecturer

2. EXPERTISE AND KNOW-HOW

- **Convexity Theory and Functional Inequalities:** Expertise in developing new classes of convex functions (harmonic, reciprocal, strong convexity) and deriving, generalizing, and improving fundamental inequalities (Jensen, Jensen–Mercer, Hermite–Hadamard), including their multidimensional extensions.
- **Mathematical Analysis on Time Scales and Mean Value Theory:** Experience in applying delta calculus and multiple Lebesgue delta integration to unify continuous and discrete models, as well as in the construction, characterization, and monotonicity analysis of new generalized means.
- **Applications in Probability Theory:** Development of inequalities for the expected value of random variables, analysis of probabilistic models using convexity methods and functional inequalities, and development of models for estimating future maximum short-duration precipitation values using extreme value theory.

- **Applications in Information Theory:** Expertise in deriving new bounds for Shannon entropy, f-divergences, and other information measures, including the development of new lower bounds and improvements of existing results.
- **Multidimensional Analysis and Abstract Spaces:** Development of results in general multidimensional settings and their applications in mathematical analysis, information theory, and related fields.
- **Mathematics Education:** Diagnosing students' misconceptions of key mathematical concepts and developing contemporary teaching methods.
- **Rough Shape and Finite Rough Shape Theory:** Study of topological spaces within the framework of rough shape and finite rough shape theory, including rough shape and finite rough shape invariants. Investigation of finite rough shape path connectedness and characterization of finite rough shape isomorphisms.
- **Technology Acceptance Models:** Development and testing of extended TAM/UTAUT models in business and educational contexts.

3. RESEARCH INFRASTRUCTURE

Laboratories

- One laboratory (classroom) for organizing seminars and workshops.

Equipment

- R, SPSS, Stata, and Overleaf.

4. KEY PROJECTS AND REFERENCES

- Climate and Extreme Weather Conditions in Croatia's Natural and Urban Environments (IP-2022-10-4144)

5. COLLABORATION OPPORTUNITIES

The research group achieves scientific results through continuous collaboration with researchers from national and international universities and research institutions. Such cooperation includes the joint development of new theoretical results, preparation of scientific publications, application for and implementation of research projects, and the exchange of knowledge and research experience. The group is open to collaboration in the fields of mathematical analysis, convexity theory, functional inequalities, probability theory, information sciences, time scale theory, and other related areas. Particular emphasis is placed on interdisciplinary research that connects mathematical methods with applications in information theory, computer science, engineering, and other scientific disciplines. Collaboration opportunities include joint research projects, scientific publications, participation in national and international projects, organization of scientific conferences and workshops, researcher mobility programs, and mentoring of early-career researchers and doctoral students. Collaboration with higher education institutions and schools also includes projects aimed at improving teaching practices, curriculum development, and the implementation of modern e-learning tools in mathematics education.

6. CONTACT

Head of Research Group: Anita.Matkovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR NUMERICAL MATHEMATICS (NumMath)

Head of the Group:

Prof. Ivan Slapničar, PhD

<https://www.croris.hr/osobe/profil/23580?lang=en>

Scientific Fields:

Natural Sciences / Mathematics

Brief Description of the Research Group:

The research group develops the theory and algorithms of numerical linear algebra for different number systems, including real, complex, quaternionic, and bicomplex structures. It focuses on efficient methods for solving eigenvalue and singular value problems, QR decompositions, structured matrices, and perturbation theory. The developed algorithms are applied to least-squares problems, image processing and classification, computation of generalized inverses, and finding polynomial roots. Additional research includes operator theory, optimization of damping in oscillatory systems, discrete evolutionary models, and the analysis of symmetric polynomials and their combinatorial applications.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Nevena Jakovčević Stor, PhD
- Assoc. Prof. Anita Kujundžić, PhD

Other faculty researchers:

- Dr. Petra Marija De Micheli Vitturi, Senior Assistant
- Marija Čatipović, M.Sc. Math., Lecturer

2. EXPERTISE AND KNOW-HOW

- Generic numerical linear algebra for matrices with entries in one of eight number systems – real numbers, complex numbers, quaternions, reduced bicomplex numbers, and dual numbers derived from the previously listed systems, including: točni i brzi matrični algoritmi,
 - accurate and fast matrix algorithms,
 - QR decomposition ,
 - algorithms for structured matrices,
 - perturbation theory for the above problems
- Application of generic algorithms to:
 - least-squares problems
 - image processing and classification
 - computation of generalized inverses
 - computation of polynomial roots
- operator theory,
- fast optimization of damping in oscillatory systems,
- discrete evolutionary models for periodic organisms,

- analysis of symmetric polynomials and their combinatorial interpretations and applications.

3. RESEARCH INFRASTRUCTURE

Laboratories

-

Equipment

- Four computers and two workstations

4. KEY PROJECTS AND REFERENCES

- Synergy of Mathematics and Physics in Engineering (SYMPHA), project IP-UNIST-11, MZOM, principal investigator: Damir Lelas, collaborators: Ivan Slapničar, Nevena Jakovčević Stor, Anita Kujundžić, Petra Marija De Micheli Vittur, Marija Čatipović, <https://www.croris.hr/projekti/projekt/17953>
- Matrix Algorithms in Noncommutative Associative Algebras (MANAA), project IP-2020-02-2240, Croatian Science Foundation, 2021–2024, principal investigator: Ivan Slapničar, collaborator: Nevena Jakovčević Stor, <http://manaa.fesb.unist.hr>
- Optimization of Parameter-Dependent Mechanical Systems (OptPDMechSys), project 9540, Croatian Science Foundation, 2015–2019, principal investigator: Ninoslav Truhar, University of Osijek, collaborators: Ivan Slapničar and Nevena Jakovčević Stor
- Fast and Accurate Matrix Algorithms and Applications, project 0023002, Ministry of Science, Education and Sports, 2002–2013, principal investigator: Ivan Slapničar, collaborator: Nevena Jakovčević Stor

5. COLLABORATION OPPORTUNITIES

Numerical linear algebra, matrix algorithms and applications, image analysis, analysis of symmetric polynomials and their combinatorial interpretations and applications.

6. CONTACT

Head of Research Group: Ivan.Slapnicar@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ADVANCED MANUFACTURING TECHNOLOGIES

Head of the Group:
Prof. Dražen Bajić, PhD

<https://www.croris.hr/osobe/profil/8940?lang=en>

Scientific Fields:
Engineering – Mechanical Engineering

Brief Description of the Research Group:

The research group focuses on the application and optimization of advanced manufacturing technologies and materials. Its research covers machining, metal forming, welding, casting, additive manufacturing, and the application of CAD/CAM systems.

Special emphasis is placed on automated and robotic manufacturing processes, mathematical modelling, microforming, and reverse engineering. Through research on advanced and difficult-to-machine materials, material recycling, and the monitoring and control of manufacturing processes, the group develops innovative and sustainable engineering solutions for industrial applications.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Sonja Jozić, PhD
- Prof. Branimir Lela, PhD
- Assist. Prof. Jure Krolo, PhD

Other faculty researchers:

- Ivana Dumanić Labetić, PhD – Senior Research Assistant
- Edin Karišik, PhD – Senior Research Assistant
- Boris Delipetar – Research Assistant
- Marijana Čelić – Research Assistant

2. EXPERTISE AND KNOW-HOW

- Machining
- Metal forming
- Additive manufacturing
- CNC machine tools
- Robotic welding
- Mathematical modelling of manufacturing processes
- CAD/CAM systems
- Manufacturing process monitoring and control
- Materials recycling
- Reverse engineering

3. RESEARCH INFRASTRUCTURE

Laboratories

- CAD/CAM Laboratory
- Machine Tools Laboratory
- Metal Forming Laboratory
- Welding Laboratory

Equipment

- CAD/CAM software packages (3DEXPERIENCE, CATIA, CIMCO, ESPRIT, WinNC, Autodesk Moldflow, NOVAFlow & Solid)
- EMCO PC Turn 50 CNC lathe
- SPINNER VC560 CNC machining centre equipped with a Cold Air Gun 610 BSP Vortec compressed-air cooling system and a Minimum Quantity Lubrication (MQL) system
- HAAS ST-10Y turn-mill centre
- Sodick VN400Q wire electrical discharge machining (Wire EDM) machine
- ZCorp Z250 3D printer
- Stratasys FDM 170 3D printer
- KISTLER cutting force and torque measurement system
- DWSOFT machining vibration monitoring system
- Filmetrics/KLA 3D optical profilometer for evaluating machined surface integrity (dimensional accuracy and surface roughness) and measuring tool wear
- MITUTOYO SJ301 surface roughness tester
- Two hydraulic presses (70 t and 100 t capacity) equipped with forming tools, dynamic and static force measurement systems, linear incremental encoder, and related instrumentation
- Robotic welding cell for both online and offline programming
- Olympus SZ61 optical microscope

4. KEY PROJECTS AND REFERENCES

- HRZZ – Alurecss: Recycling of aluminium alloys in the solid and semi-solid state
- SPIN – AxisTech: Strategic partnership for the development of innovative machining centres
- IRI S3 – ReforsTech: Strengthening R&D capacities for globally competitive, green, and innovative technologies and services
- IRI S3: Development of lightweight polymer vehicle body components to improve vehicle energy efficiency

5. COLLABORATION OPPORTUNITIES

The group's research expertise includes:

- Machining
- Metal forming
- Welding
- Casting
- Additive manufacturing
- CAD/CAM technologies

Particular emphasis is placed on automated and robotic manufacturing, mathematical modelling, microforming, and reverse engineering. Through research on advanced and difficult-to-machine materials, material recycling, and manufacturing process monitoring and control, the group develops innovative and sustainable engineering solutions tailored to industrial needs.

Opportunities for Industrial Collaboration

- Product design using the CATIA 3D CAD platform
- Design and manufacturing of prototypes using additive manufacturing technologies or CNC machining on advanced machine tools
- Machinability studies of difficult-to-machine materials
- Surface integrity evaluation using a 3D optical profilometer

6. CONTACT

Head of Research Group: Drazen.Bajic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR MATERIALS ENGINEERING AND TRIBOLOGY

(InMaT)

Head of the Group:

Assist. Prof. Nikša Čatipović, PhD

<https://www.croris.hr/osobe/profil/31662?lang=en>

Scientific Field:

Mechanical Engineering

Brief Description of the Research Group:

The research group specializes in the development, characterization, and optimization of metallic and non-metallic materials, as well as surface coatings. It possesses expertise in material selection, heat treatment, surface protection of metals, and non-destructive testing of materials. The group's competencies include metallographic analysis, mechanical property testing, and tribological investigations, together with the development of innovative solutions aimed at improving the durability, reliability, and functionality of materials. Through its research and development activities, the group contributes to the advancement of materials and technologies for a wide range of industrial applications.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Jelena Čulić-Viskota, PhD

Other faculty researchers:

- Karla Kunac, M.Eng. in Industrial Engineering – Research Assistant
- Karla Antunović, M.Eng. in Mechanical Engineering – Research Assistant
- Damir Jurić, M.Eng. in Mechanical Engineering – Research Assistant
- Petar Ljumović, M.Eng. in Mechanical Engineering – Laboratory Technician

2. EXPERTISE AND KNOW-HOW

- Material selection
- Heat treatment and surface protection of metals
- Non-destructive testing (NDT) of materials
- Metallographic analysis
- Mechanical property testing
- Tribology
- Development and research of novel metallic and non-metallic materials
- Development and research of surface coatings

3. RESEARCH INFRASTRUCTURE

Laboratories

- Heat Treatment Laboratory
- Mechanical Testing Laboratory

- Non-Destructive Testing Laboratory
- Metallographic Testing Laboratory
- Advanced Materials and Tribology Laboratory

Equipment

- Optical microscopes, metallographic image analyzer, microhardness tester, precision balances
- Laboratory furnaces with and without controlled atmosphere capability, salt bath system for isothermal heat treatment
- Equipment for testing fundamental mechanical properties, including strength, hardness, toughness, ductility, fatigue resistance, and dynamic durability
- Ultrasonic testing (UT), magnetic particle testing (MT), radiographic testing (RT), penetrant testing (PT), and eddy current testing (ET) equipment
- Tribological testing equipment for friction and wear analysis, single-screw extruder for the development of novel polymer filaments for 3D printing, and vacuum infusion equipment for composite material manufacturing

4. KEY PROJECTS AND REFERENCES

- PoC SBPolyFil
- INTERREG Italy-Croatia AI4BLUE
- INTERREG Danube D4AM

5. COLLABORATION OPPORTUNITIES

The research group specializes in materials engineering and comprehensive material characterization, offering extensive opportunities for collaboration with academic institutions, industrial partners, and research and development centers. The group's expertise encompasses advanced material selection methodologies supported by 3D modelling and the Design-Expert software package, as well as optimization of material selection under predefined constraints.

Particular attention is devoted to non-destructive testing methods, metallographic characterization of material structures, and heat treatment processes aimed at optimizing mechanical properties, including strength, hardness, and toughness. The group also demonstrates strong expertise in the field of tribology, with a focus on detailed investigations of material surface wear and degradation mechanisms.

Significant experience has been gained in the development and testing of metallic and polymeric foams, as well as biopolymeric materials, with emphasis on their mechanical, structural, and functional properties. Collaboration opportunities include joint research projects, the development of novel materials and technologies, mechanical and structural testing, optimization of manufacturing processes, and the resolution of specific industrial challenges.

The group is open to bilateral collaborations, participation in European research programmes (such as Horizon Europe, Interreg, and related initiatives), joint doctoral studies, and knowledge and technology transfer activities with industry. Such partnerships foster innovative solutions in materials engineering and contribute to the development of competitive products and manufacturing processes.

6. CONTACT

Head of Research Group: Niksa.Catipovic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR INDUSTRIAL ENGINEERING (IENG)

Head of the Group:

Assoc. Prof. Nikola Gjeldum, PhD

<https://www.croris.hr/osobe/profil/6961?lang=en>

Scientific Field:

Mechanical Engineering and Basic Technical Sciences

Brief Description of the Research Group:

The Industrial Engineering Research Group focuses on the development and application of advanced approaches to managing manufacturing, logistics, and service systems in accordance with the concepts of Industry 4.0 and Industry 5.0. The group's expertise includes multi-criteria decision-making, Lean, Green and Digital Management, process modelling and simulation, digital twins, IoT and machine-to-machine (M2M) communication, and Manufacturing Execution System (MES) development. The group actively develops a Learning Factory and smart manufacturing demonstration laboratories, conducts research on quality management and complex assembly systems, and participates in international research and educational initiatives.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Associate Professor Nikola Gjeldum, PhD
- Full Professor Boženko Bilić, PhD
- Associate Professor Marko Mladineo, PhD

Other faculty researchers:

- Professor Emeritus Ivica Veža, PhD
- Marina Crnjac Žižić, PhD, Senior Teaching and Research Assistant
- Amanda Aljinović Meštrović, PhD, Senior Teaching and Research Assistant

2. EXPERTISE AND KNOW-HOW

- Research and implementation of modern organisational principles based on Lean, Green and Digital Management through projects and industrial case studies.
- Development of scalable Manufacturing Execution Systems (MES) for communication with and data acquisition from manufacturing, assembly, and service workstations.
- Development and implementation of Industry 4.0/5.0 technologies in industrial environments and laboratory settings.
- Development of Machine-to-Machine (M2M) communication using the MQTT (Message Queuing Telemetry Transport) protocol.
- Application of multi-criteria decision-making methods to improve engineering design, manufacturing, logistics, and service systems and processes.
- Development of the FESB Learning Factory, inspired by laboratories and institutions within the International Association of Learning Factories (IALF) and adapted to Croatian industrial needs.

- Management of assembly systems using proprietary control algorithms based on assembly system complexity indicators.
- Modelling and simulation of real assembly processes through digital twins using robots, sensors, actuators, IoT platforms, and Siemens Tecnomatix Plant Simulation software.
- Development of decision-support procedures for Mixed-Model Assembly Line (MMAL) balancing through the integration of assembly complexity indicators.
- Quality management in Industry 4.0/5.0.
- Design and development of unique complex electro-mechanical assemblies and mechanisms for material handling and transport applications.

3. RESEARCH INFRASTRUCTURE

Laboratories

- Industrial Engineering Laboratory
- Laboratory for Dimensional, Form and Position Measurement

Equipment

- Server with eight workstation PCs
- Plotter
- 80 Siemens PLM software licences (NX CAD, Tecnomatix, Teamcenter)
- Two 3D printers
- 3D scanner
- 3D television with 3D glasses
- Pick-by-Light warehouse support system
- FESTO Pick & Place assembly station
- Six assembly workstations for gearbox assembly with supermarket storage systems
- Conveyor belt for gearbox assembly line
- Four reconfigurable assembly workstations for different products
- RFID- and Raspberry Pi-based assembly monitoring and control system with LCD displays
- FRANKA collaborative robot
- Automated Guided Vehicle (AGV) with automated load unloading
- Five VisTable software licences
- Machine tools for machining small workpieces (cutting, drilling, turning, and milling)
- MarForm MMQ 200/T20W instrument for measuring form, orientation, position, and runout deviations
- Various measuring instruments
- Servo-electric drive development workstation
- Arduino-based simulation workstation

4. KEY PROJECTS AND REFERENCES

- An Excellence-Based Curriculum for the Improvement of LEAN & Green Management Skills in SMEs (EXCURS), 2022–2025, International, Erasmus+, Project Coordinator: Begona Benito
- Development of an Integrative Procedure for the Management of Production and Service Improvement Processes (DEPROCIM), 2017–2019, International, Unity

through Knowledge Fund (UKF), Project Leader: Assistant Professor Nikola Gjeldum, PhD

- Logistics Personal Excellence by Continuous Self-Assessment (LOPEC), 2012–2014, International, EU Leonardo da Vinci Programme, Project Leader: Professor Vera Hummel, PhD
- Implementation projects and follow-up collaboration with a total of nine industrial companies that served as pilot partners in the EXCURS, DEPROCIM, and LOPEC projects.
- Collaborative research and technology transfer projects with more than ten industrial partners.

5. COLLABORATION OPPORTUNITIES

- Scientific and professional collaboration with universities, faculties, and members of the International Association of Learning Factories (IALF) in the development of Learning Factory concepts and the preparation of EU-funded research projects.
- Industrial collaboration in manufacturing and service process improvement, Lean & Green Management, implementation of Industry 4.0/5.0 manufacturing paradigms, and Manufacturing Execution System (MES) development.

6. CONTACT

Head of Research Group: Nikola.Gjeldum@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR NAVAL ARCHITECTURE (NARC)

Head of the Group:

Branko Blagojević

<https://www.croris.hr/osobe/profil/5747?lang=en>

Scientific Field:

Engineering Sciences / Naval Architecture and Marine Engineering

Brief Description of the Research Group:

The research group focuses on the ship design, marine structures, and advanced marine vehicles. The activities include conceptual and detailed design, hydrodynamic performance analysis, development of innovative propulsion systems, application of advanced manufacturing technologies, and assessment of structural reliability and safety. By combining theoretical and numerical approaches, the group contributes to the development of innovative and sustainable solutions for modern shipbuilding and the maritime industry.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Dario Ban, PhD
- Prof. Boris Ljubenkovic, PhD
- Assist. Prof. Josip Bašić, PhD

Other faculty researchers:

- Martina Bašić, PhD

2. EXPERTISE AND KNOW-HOW

- Ships, offshore, and advanced marine vehicles design
- Hydrodynamics and propulsion
- Shipbuilding technologies
- Structural analysis

3. RESEARCH INFRASTRUCTURE

Laboratories

- Shipbuilding Technology Laboratory (a)
- Numerical Hydrodynamics and Advanced Marine Vehicles Laboratory (b)

Equipment

- Complete equipment for the manufacturing of composite vessels up to 6 m in length (a)
- Workstations and software tools (both proprietary and licensed)

4. KEY PROJECTS AND REFERENCES

- Autonomous Adaptive Control of Underwater Vehicles.
- Advanced procedure for Design of Energy Saving Devices on Existing Ships.
- Design and Hydrodynamic Performance of Autonomous SWATH Craft.
- Development of an Innovative Augmented Reality-Based Approach to Ship Outfitting Processes
- Advanced Ship Design for Pollution Prevention.

5. COLLABORATION OPPORTUNITIES

The research group offers a wide range of collaboration opportunities with industry partners, shipyards, maritime companies, and research institutions in the field of naval architecture. The group is focused on development and application of advanced numerical tools for ship hydrodynamics and propulsion analysis, and design of advanced marine vehicles like AUVs and SWATH crafts. The group has developed novel meshless CFD methods (e.g. LDD method), tools for vessel geometry interpolation techniques based on Radial Basis Functions (RBF), and advanced numerical models that enable rapid and reliable hull-form optimization, hydroelasticity assessment, and fluid–structure interaction (FSI) simulations. These approaches are complemented by machine-learning methods for ship motion control. The group is also actively involved in the application of augmented reality technologies for ship production, outfitting, and inspection processes. Collaboration can be established through joint research and development projects, expert studies, consultancy and testing services, as well as joint applications for national and EU-funded projects related to sustainable and innovative shipbuilding and maritime technologies.

6. CONTACT

Head of Research Group: Branko.Blagojevic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ADVANCED EXPERIMENTAL MECHANICS AND INTELLIGENT STRUCTURES (AEMIS)

Head of the Group:

Prof. Lovre Krstulović-Opara, PhD

<https://www.croris.hr/osobe/profil/7306?lang=en>

Scientific Field:

Engineering Sciences / Mechanical Engineering

Brief Description of the Research Group:

The research group develops advanced experimental mechanics and non-destructive testing methods using infrared thermography, Digital Image Correlation (DIC), and artificial intelligence. Research activities focus on deformation assessment, the development and characterization of auxetic, TPMS (Triply Periodic Minimal Surface), and hybrid cellular structures, together with the analysis of energy absorption properties of polymer composites, and the development of thermographic data processing methods for non-destructive evaluation. The group also conducts biomechanical testing of bone structures and applies machine learning algorithms for the classification and identification of building structures based on thermographic imagery.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Lovre Krstulović-Opara, PhD
- Assist. Prof. Petra Bagavac, PhD
- Željko Domazet, PhD, Professor Emeritus

Other faculty researchers:

- Alen Grebo, MEng, Research Assistant
- Juraj Radačić, MEng (Industrial Engineering), Senior Laboratory Technician, Teaching and Research Assistant
- Ante Medvidović, MEng, Teaching and Research Assistant

2. EXPERTISE AND KNOW-HOW

- Development of advanced deformation evaluation methods based on machine learning through the correlation of thermographic data and Digital Image Correlation (DIC).
- Development, dynamic testing, and thermographic/DIC evaluation of novel auxetic, TPMS, and hybrid cellular structures.
- Evaluation of energy absorption characteristics of polymer composites manufactured using additive manufacturing and polymer injection molding technologies.
- Non-destructive testing of metals and composites using active infrared thermography.
- Development of advanced thermographic image processing and filtering techniques for non-destructive evaluation.
- Biomechanical testing and analysis.
- AI-based classification of thermographic images for building structure identification and characterization.

3. RESEARCH INFRASTRUCTURE

Laboratories

- FESB B111, C706/A, C707

Equipment

- INSTRON servo-hydraulic dynamic testing machine
- Instrumented INSTRON 9450 drop tower (impact energy up to 1.8 kJ, impact velocity up to 24 m/s)
- FLIR SC5000 cooled mid-wave infrared camera
- 6 kJ Xenon flash system
- HBM MGCplus multi-channel measurement amplifier for strain gauges and thermocouples
- Non-destructive testing equipment: ultrasonic testing, liquid penetrant testing, magnetic particle inspection, and UV lamp
- NextEngine 3D scanner
- Prusa i3 MK3S fused filament fabrication (FFF) 3D printer, Prusa SL2 Speed stereolithography (SLA) 3D printer
- Krautkramer DM4 thickness gauge
- Krautkramer USM Go ultrasonic flaw detector with straight-beam, angle-beam, and composite testing probes
- AlphaDur Mini UCI hardness tester
- DynaRock II rebound hardness tester
- FLIR E96 long-wave infrared camera (thermal sensitivity 0.04 K, resolution 640 × 420 pixels)

4. KEY PROJECTS AND REFERENCES

- STRENGTH INTERREG Italy-Croatia
- AIRRSTRUCT Institutional Research Project

5. COLLABORATION OPPORTUNITIES

- Thermographic inspection and analysis of equipment, industrial plants, buildings, and engineering structures.
- Detection, assessment, and remediation recommendations for moisture and condensation-related issues in buildings.
- Static and dynamic testing of structures (using strain gauge measurements and thermoelastic stress analysis) and materials (using a servo-hydraulic dynamic testing machine).
- Impact testing at velocities up to 24 m/s (drop tower testing).
- Ultrasonic testing and inspection.
- Liquid penetrant and magnetic particle testing.
- Visual inspection.
- Measurement of protective coating thickness on metal structures.
- In-situ material hardness testing.
- Finite Element Analysis (FEA).
- CAD modeling and design.
- 3D scanning and digitization.

6. CONTACT

Head of Research Group: Lovre.Krstulovic-Opara@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ENERGY EFFICIENCY, RENEWABLE ENERGY SOURCES, AERODYNAMIC MODELLING, AND AERO-ENERGY SYSTEMS (EOAS)

Head of the Group:

Prof. Sandro Nižetić, PhD

<https://www.croris.hr/osobe/profil/252?lang=en>

Scientific Fields:

Engineering Sciences / Basic Engineering Sciences

Brief Description of the Research Group:

The research activities of the group encompass thermodynamic and numerical modelling of fluid flow and thermo-fluid phenomena, as well as experimental investigations of energy transformations and conversion processes in hybrid energy systems and individual technologies based on renewable energy sources. Additional research areas include improving the efficiency and durability of photovoltaic systems, developing novel waste-based phase change materials, aerodynamic modelling of unmanned aerial vehicles (UAVs), and the development and application of smart technologies to enhance thermal comfort and reduce energy consumption in buildings. The overall objective of the group's research is to develop innovative solutions for more efficient energy utilization while minimizing adverse environmental impacts.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Sandro Nižetić, PhD
- Assist. Prof. Mišo Jurčević, PhD

Other faculty researchers:

- Ivan Čorić, MEng (Mechanical Engineering)
- Jelena Bošnjak, MEng (Industrial Engineering)

2. EXPERTISE AND KNOW-HOW

- Thermodynamic and numerical modelling of fluid flow and thermo-fluid phenomena
- Analysis of energy conversion and transformation processes across various applications
- Analysis of hybrid renewable energy systems
- Aerodynamic modelling of unmanned aerial vehicles (UAVs)
- Enhancement of the energy efficiency and durability of photovoltaic technologies
- Energy efficiency in buildings
- Development and application of smart building technologies for improving thermal comfort
- Development of waste-based phase change composite

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Thermodynamics and Energy Efficiency (LTEF)

- Laboratory for Aero and Hybrid Energy Systems (LAHES)

Equipment

- THW-L1 – Thermal conductivity measurement device for liquids and pastes
- Thermtest HFM-100 (100 Series) – Heat Flow Meter
- Hot Disk TPS 500 S – Thermal Constants Analyzer
- ViscoQC 300-L – Viscometer
- Data loggers for monitoring process parameters (temperature, pressure, flow velocity, heat flux)
- FLIR E76 – Infrared thermal imaging camera

4. KEY PROJECTS AND REFERENCES

- Research and Application of Novel Phase Change Composites for Operating Temperature Regulation of Silicon Photovoltaic Panels (IP-2022-10-3971)
- Smart Hybrid Cooling Techniques for Silicon Photovoltaic Panels (IP-01-2018-2814)
- Application of Biosensors for Investigating Thermal Comfort Conditions in Public Office Buildings with the Aim of Optimizing Energy Consumption and Integrating Data into the ESCO MONITOR Platform
- Development and Research of Ice Platforms, DIV Group Ltd.
- UNDP Project: Removing Barriers to Energy Efficiency in Croatia
- New Aspects of Solar Energy Utilization in Solar Chimney Power Plants (023-0231751-3011)
- Significant Reduction of Solar Chimney Power Plant Height, Ministry of Science, Education and Sports
- IR-103 (IRI2): Development of a Zero-Emission Passenger Sailing Vessel, European Regional Development Fund (ERDF)
- Numerical Simulations of the Welding Process for Thick-Walled Reactor Heat Exchangers, EU Industrius (Technical Study)
- Techno-Economic Assessment for the Conceptual Design of the Thermal Energy System for the Poljud Swimming Pools Complex
- Development of Multi-Purpose Heat Pumps with a Proposal for Industrial Production (Technical Study)
- Preliminary Assessment of the Jelina Draga 850 kW Solar Power Plant (Technical Study)
- Thermodynamic Assessment of Rapid Thermal Shock Potential, Interdisciplinary Expert Working Group Investigating the Kornati Island Fire (Expert Report)
- Thermal Energy Consumption Study for the Following Facilities: Poljud Swimming Pools Sports Complex, Poljud City Stadium, Croatian Hydrographic Institute, and Maritime Electronics Centre (Technical Study)
- Conceptual HVAC Design for the TDM Administrative Building (Technical Study)
- Conceptual Design Study of a Multi-Purpose Thermal Energy Plant for Air Conditioning and Recreational Ice Rink Operation (Technical Study)
- Conceptual Design Study of an Energy-Optimal HVAC System for the Poljud Swimming Pools Sports Complex (Technical Study)

5. COLLABORATION OPPORTUNITIES

The research group specializes in the development, analysis, numerical modelling, and experimental investigation of individual technologies and integrated systems in the field of mechanical engineering energy systems, with a particular emphasis on renewable energy sources. The group possesses expertise in the development of advanced materials, particularly phase change composites, as well as in the implementation of smart building technologies aimed at improving thermal comfort and enhancing energy efficiency. The group also has extensive experience in preparing technical studies, feasibility analyses, and expert reports for industrial partners and the energy sector.

6. CONTACT

Head of Research Group: sandro.nizetic@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR DIAGNOSTICS AND OPTIMISATION OF HYBRID ENERGY SYSTEMS (OPTIHYB)

Head of the Group:

Prof. Gojmir Radica, PhD

<https://www.croris.hr/osobe/profil/2759?lang=en>

Scientific Field:

Engineering Sciences / Mechanical Engineering

Brief Description of the Research Group:

The research group focuses on the development and optimisation of hybrid energy systems for mobile, stationary, and marine applications. Its activities encompass the modelling, monitoring, diagnostics, and optimisation of systems integrating internal combustion engines, batteries, fuel cells, renewable energy sources, and alternative fuels. Particular emphasis is placed on developing advanced technologies for system monitoring, emissions reduction, and energy efficiency improvement, as well as on the development of digital twins and innovative energy supply concepts. Through experimental and computational research, the group contributes to the transition towards sustainable, low-emission, and highly efficient energy systems.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Gojmir Radica, PhD
- Assist. Prof. Željko Penga, PhD

Other faculty researchers:

- Bruno Ševo, MSc in Mechanical Engineering
- Zoran Drašković, MSc in Mechanical Engineering

2. EXPERTISE AND KNOW-HOW

- Monitoring, diagnostics, and optimisation of hybrid energy systems
- Modelling of hybrid energy systems:
- Mobile systems: internal combustion engines, batteries, fuel cells
- Stationary systems: internal combustion engines, wind energy, solar energy, batteries, fuel cells
- Marine systems: internal combustion engines, fuel cells, batteries, alternative fuels, and renewable energy sources
- Advanced technologies for monitoring, optimisation, and emissions reduction in stationary and mobile hybrid energy systems
- Innovative concepts for energy supply based on hybrid energy systems
- Analysis of complex energy systems
- Development of digital twins for energy systems

3. RESEARCH INFRASTRUCTURE

Laboratories

- Thermal Machinery Laboratory

Equipment

- CFD computing server, 3D printer, CNC milling machine, and laser cutter for rapid prototyping and development of hybrid-system components, including fuel cell components
- Hybrid powertrain test bench with internal combustion engine
- Emissions analyser
- In-cylinder pressure measurement and combustion analysis systems
- Fluid flow measurement equipment
- Temperature sensing and monitoring systems
- Remote monitoring systems for energy-system operational parameters (Patent no.:D20250110A)
- Fuel cell test station
- Ten engineering workstations equipped with AVL software licences (BOOST, CRUISE M, and FIRE CFD) for modelling, simulation, and virtual testing of complex energy systems

4. KEY PROJECTS AND REFERENCES

- Development of a Water Curtain System for Preventing Seawater Intrusion, Strategic Partnerships for Innovation in Industrial Transition Programme (IP.1.1.03.0113), Principal Investigator at FESB: G. Radica (2024–2027)
- Micro Fuel Cells as an Alternative Power Source for Mobile Devices (MFC2GO), EU Recovery and Resilience Facility (NPOO), Project No. C3.2.R3-I1.01.0232, Principal Investigator: Ž. Penga (2024–2025)
- Advanced Technologies for Autonomous Systems (ATASYS), University of Split Institutional Research Project (IP-UNIST-06), funded through the National Recovery and Resilience Plan 2021–2026, Principal Investigator: Ž. Penga
- HRZZ IP-2025-02-1981 – HyRefuelStat, Research Team Member: G. Radica (2025–2028)
- HRZZ IP-2024-05-6299 – Coordinated Hydrogen and Electricity Systems and Markets, Research Team Member: Ž. Penga (2024–2027)

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with industry, public-sector organisations, and academic partners in the development and deployment of advanced hybrid energy systems for mobile, stationary, and marine applications. Collaboration opportunities include joint research and development projects, industrial testing and technology validation, feasibility studies, and optimisation of existing systems aimed at improving energy efficiency and reducing emissions. Particular interest is devoted to the integration of internal combustion engines, battery systems, fuel cells, renewable energy sources, and alternative fuels. The group offers expertise in modelling, monitoring, diagnostics, and optimisation of complex energy systems, as well as in the development of digital twins for predictive control and operational optimisation. Potential forms of cooperation include joint R&D and innovation projects, technology transfer and commercialisation, development of innovative energy supply concepts, participation in national

and European funding programmes, professional training and capacity building, technical consultancy and support for implementing advanced energy solutions. Special emphasis is placed on solutions aligned with regulatory requirements, sustainability objectives, and decarbonisation strategies.

6. KONTAKT

Head of Research Group: gojmir.radica@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR DYNAMICS AND VIBRATIONS (KDV)

Head of the Group:
Prof. Damir Sedlar, PhD

<https://www.croris.hr/osobe/profil/2357?lang=en>

Scientific Field:

Engineering Sciences / Mechanical Engineering, Fundamental Engineering Sciences

Brief Description of the Research Group:

The Dynamics and Vibrations Research Group focuses on the study of dynamic behaviour in engineering systems through a combination of experimental and numerical approaches. Its expertise includes experimental and numerical modal analysis, dynamic system identification, and the investigation of nonlinear dynamic phenomena. Research activities encompass vibration analysis using high-speed camera recordings, fatigue assessment, and the development of methods for structural damage detection and lifetime prediction. The group also develops and applies advanced numerical techniques, including meshless methods and multiphase fluid modelling, with the aim of improving the reliability, safety, and performance of engineering systems and structures.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Professor Ivan Tomac, PhD (<https://www.croris.hr/osobe/profil/27590>)
- Prof. Emeritus Željko Lozina (<https://www.croris.hr/osobe/profil/17223>)

2. EXPERTISE AND KNOW-HOW

Experimental Dynamics and Measurements

- Experimental and Operational Modal Analysis (EMA / OMA)
- Non-contact vibration measurements using Laser Doppler Vibrometer (LDV scanning)
- Vibration and deformation analysis from high-speed camera recordings
- Noise measurement and analysis, including vibroacoustic diagnostics
- Experimental excitation of structures (modal shakers and impact hammer testing)

Numerical Modelling and System Identification

- Dynamic system identification (linear and nonlinear systems)
- Dynamic analysis of nonlinear systems
- Finite element methods, Meshless numerical methods and multiphase fluid modelling
- Correlation and updating of numerical models based on experimental data
- Numerical shape synthesis and geometry optimisation through advanced parameterisation techniques

Structural Reliability and Integrity

- Fatigue analysis and service-life prediction
- Structural health monitoring and damage assessment
- Vibroacoustic optimisation of engineering structures (e.g. ship structures)

3. RESEARCH INFRASTRUCTURE

Laboratories

- Vibrations and Noise Laboratory
- Machine Dynamics Laboratory

Equipment

- Advanced measurement and data acquisition systems, including: Polytec PSV-500 Scanning Laser Doppler Vibrometer (LDV)
- Laser Doppler Vibrometer Polytec OFV-1102 with OFV-200 controller
- Experimental modal analysis software packages (MEScope and ModalVIEW)
- Vibration excitation systems (TIRA shakers and Dongling ES-1-15 shaker)

4. KEY PROJECTS AND REFERENCES

- Numerical Synthesis of 3D Shapes with Advanced Geometry Parameterisation, Experimental Validation, and Feedback-Based Numerical Model Updating (HRZZ IP-2022-10-8856)
- Development of Innovative Composite Structures for Sound Insulation (CEKOM – IRI 1)
- Development of an Advanced Integrated Numerical Procedure for Optimising Ship Vibroacoustic Performance in Early Design Stages (CEKOM – IRI 2)
- Evolutionary Shape Synthesis with Integral and Partitioned 3D Phenotypes, Dynamic Parameterisation, and Meshless Modelling (HRZZ IP-2018-01-6774)

5. COLLABORATION OPPORTUNITIES

The group welcomes collaboration in the fields of dynamics, vibrations, noise control, and optimisation of structures and mechanical systems. Cooperation can be established through research and innovation projects, contract research, technical consultancy, expert assessments, and student and doctoral research projects.

Services and Collaboration Activities:

- Experimental modal and operational analysis of structures and machinery
- Laboratory and field measurements of vibrations and noise
- Identification of excessive vibration sources and development of corrective measures
- Numerical analyses (FEM), model validation, and model updating based on measurement data
- Assessment of fatigue, structural integrity, and remaining useful life
- Vibroacoustic optimisation of products and structures during early design stages

Academic Mobility and International Cooperation: The group actively supports international collaboration through the Erasmus+ programme, including: Student, doctoral researcher, and staff exchanges, Joint supervision of theses and dissertations, Guest lectures and research visits, Collaborative research initiatives

Target Sectors: Shipbuilding and marine engineering, mechanical and process industries, transportation systems, energy sector, civil and structural engineering

Deliverables: measurement and diagnostic reports, validated numerical models, engineering recommendations for vibration and noise reduction, reliability improvement strategies for engineering systems and structures

6. CONTACT

Head of Research Group: Damir.Sedlar@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR APPLIED THERMODYNAMICS AND ENERGY CONVERSION ENGINEERING

Head of the Group:

Assoc. Prof. Ivan Tolj, PhD

<https://www.croris.hr/osobe/profil/27591?lang=en>

Scientific Field:

Engineering Sciences / Mechanical Engineering

Brief Description of the Research Group:

The research group focuses on the development and application of hydrogen technologies for sustainable energy systems. Its research activities cover hydrogen production, storage, compression, and utilisation, with particular emphasis on electrolyzers, fuel cells, and metal hydride storage systems. The group conducts research on diagnostics and degradation analysis of electrochemical components, develops advanced control algorithms for hydrogen systems, and optimises their efficiency, reliability, and lifetime. Additional research areas include the integration of fuel cells into mobile and industrial applications, as well as the development of innovative solutions for incorporating hydrogen technologies into renewable energy systems and supporting the energy transition.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Prof. Emeritus Dr. Frano Barbir
- Assist. Prof. Ivan Pivac, PhD

Other faculty researchers:

- Jakov Šimunović, PhD, Research Assistant

2. EXPERTISE AND KNOW-HOW

- Hydrogen integration in renewable energy systems
- Integration of fuel cells into industrial vehicles (forklifts)
- Diagnostics and degradation analysis of electrochemical hydrogen compressors
- Hydrogen production by water electrolysis, including the impact of operating conditions on electrolyser performance and durability
- Design and optimisation of metal hydride hydrogen storage systems with enhanced heat transfer management
- Characterisation of metal hydride storage systems during hydrogen absorption and desorption processes
- Fuel cell design, operation, and applications
- Development of control algorithms for fuel cell and electrolyser systems
- Experimental testing and characterisation of electrochemical compressors

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Advanced Thermal Energy Technologies (C516)

Equipment

- Fuel cell test station for single-cell testing across various cell sizes (Teledyne Medusa), equipped with integrated Frequency Response Analysis (FRA) electronics
- Fuel cell test station for single cells and small fuel-cell stacks of various sizes (Scribner Associates)
- PEM electrolyser test station for single-cell testing (Sustainable Innovations Test Station for PEM Electrolyzers)
- Potentiostat/Galvanostat (BioLogic SP-150) with external current booster up to 10 A for advanced electrochemical testing, Base unit: ± 10 V, ± 400 mA, Current booster: ± 10 V, ± 10 A
- S++ Current and Temperature Scanner featuring: Local current measurements at 121 measurement points, temperature measurements at 49 measurement points, measurement ranges: 0–2 V and 0–100 °C, fuel cell active area: 50 cm²
- Stand-alone hydrogen energy system consisting of: Solar photovoltaic array (1.6 kW), Wind turbine (1.4 kW), PEM electrolyser (2.8 kW, maximum pressure 30 bar), Hydrogen storage system (600 L volume, 1.5 kg H₂ capacity), Fuel cell system (1.2 kW electrical output), Battery storage (24 V, 1000 Ah), DC/AC inverter (3.5 kW), Programmable electrical load (up to 1.5 kW)

4. KEY PROJECTS AND REFERENCES

- **HyRefuelStat – Development of a High-Efficiency Metal Hydride Compressor with Integrated Thermal Energy Storage for Advanced Hydrogen Refuelling Stations**
Croatian Science Foundation (HRZZ), Principal Investigator: Associate Professor Ivan Tolj, 2025–2028
- **HYTECH – Advanced Diagnostics and Prognostics for Efficient Green Hydrogen Production and Utilisation**
Croatian Science Foundation (HRZZ), Principal Investigator: Assistant Professor Ivan Pivac, 2026–2031
- **LUMINIH2 – Laboratory Model and Prototype Control and Monitoring System for Renewable-Energy Microgrids with Hydrogen Technologies**
Targeted Scientific Research Programme, NPOO.C3.2.R3-I1.04
- **International Engineering Competence Centres for Sustainable Mobility Development in Albania and Montenegro**
Erasmus+ Capacity Building Project (ERASMUS-LS), 2023–2026
- **Increasing Efficiency, Reducing Harmful Emissions and Hybridisation of Marine Energy Systems**, Croatian Science Foundation (HRZZ), 2021–2025

5. COLLABORATION OPPORTUNITIES

The research group welcomes collaboration with universities, research institutes, industry partners, and public-sector organisations in the field of hydrogen technologies and sustainable energy systems. Particular interest lies in the joint development and deployment of technologies for hydrogen production, storage, compression, and utilisation, including electrolyzers, fuel cells, and metal hydride systems. Potential forms of collaboration include joint national and international research projects, the development of innovative products and prototypes, industrial testing and validation, technology transfer, as well as technical studies and expert analyses. The group has access to state-of-the-art research infrastructure for the experimental testing of fuel cells, electrolyzers, electrochemical compressors, and hydrogen storage systems, enabling advanced research and the validation of novel technologies and solutions. The group is especially interested in collaborations focused on integrating hydrogen technologies into transportation, industry, microgrids, and renewable energy systems, as well as projects supporting the energy transition and decarbonisation. In addition, the group offers opportunities for joint supervision of undergraduate, graduate, and doctoral students, organisation of workshops and professional training programmes, and the exchange of researchers, expertise, and knowledge.

6. CONTACT

Head of Research Group: Ivan.Tolj@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR MECHANICAL STRUCTURAL INTEGRITY AND THE DEVELOPMENT OF INDEPENDENTLY CONTROLLED GEAR TRANSMISSIONS

Head of the Group:

Assist. Prof. Vjekoslav Tvrđić, PhD

<https://www.croris.hr/osobe/profil/32612?lang=en>

Scientific Field:

Engineering Sciences / Mechanical Engineering

Brief Description of the Research Group:

The research group focuses on the reliability, durability, and structural integrity of mechanical systems, with particular emphasis on fatigue, fracture mechanics, and mechanical power and motion transmission systems. Its research activities include the assessment of damage initiation and propagation, service-life prediction of structural and machine components, and failure analysis under dynamic loading conditions.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assist. Prof. Milan Perkušić, PhD

Other faculty researchers:

- Stipe Pleština, MSc in Mechanical Engineering

2. EXPERTISE AND KNOW-HOW

- Fatigue analysis
- Fracture mechanics
- Mechanical power and motion transmission systems
- Energy harvesting systems (energy harvesters and energy scavengers)

3. RESEARCH INFRASTRUCTURE

Laboratories

- Machine Elements Laboratory (C809), equipped with educational and research models of machine elements

Equipment

- Custom-designed test rig and prototype regenerative hydraulic device for harvesting vibration energy from mechanical systems

4. KEY PROJECTS AND REFERENCES

- Strength and Durability of Machine Elements **(2000–2002)**
- Fatigue Crack Initiation in Machine and Structural Components **(2003–2005)**
- Dynamic Strength of Thermally Cut Structural Components (2008–2010)

5. COLLABORATION OPPORTUNITIES

- Fracture Mechanics – application of fracture mechanics principles and methodologies to assess the service life, damage evolution, and structural integrity of machine components and load-bearing structures.
- Mechanical Power and Motion Transmission Systems, as well as General Machine Elements – engineering analysis, design calculations, technical consultancy, and scientific research related to individual machine components and complete mechanical assemblies.
- Energy Harvesting Technologies – numerical and experimental research on systems that capture and convert ambient energy into usable power, including vibration-based and other energy harvesting solutions.
- Polymer Gears – experimental investigation of the performance, durability, wear behaviour, and application potential of polymer-based gear systems.

6. CONTACT

Head of Research Group: Vjekoslav.TvrDIC@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR LINEAR AND NONLINEAR ANALYSIS OF THIN-WALLED STRUCTURES (LINATK)

Head of the Group:
prof. Frane Vlak, PhD

<https://www.croris.hr/osobe/profil/4121?lang=en>

Scientific Fields:

Engineering Sciences – Fundamental Engineering Sciences

Engineering Sciences – Mechanical Engineering

Engineering Sciences – Naval Architecture and Marine Engineering

Brief Description of the Research Group:

The research group specializes in elasticity theory, thin-walled members and structural systems analysis, ship structures, wind turbine structures, composite and orthotropic materials including materials produced using additive manufacturing technologies. Research activities focus on the structural analysis of thin-walled structures, the development of elasto-plastic constitutive models, structural reliability and uncertainty assessment, as well as parameter identification and model selection using Bayesian methods. The comprehensive goal is to enhance the reliability, safety, and efficiency of engineering structures through the implementation of advanced numerical and probabilistic approaches.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Radoslav Pavazza, PhD, Professor Emeritus
- Prof. Jani Barle, PhD
- Prof. Vedrana Cvitanić, PhD
- Assoc. Prof. Marko Vukasović, PhD
- Assist. Prof. Branka Bužančić Primorac, PhD
- Assist. Prof. Stipe Perišić, PhD

Other faculty researchers:

- Maja Džoja, PhD

2. EXPERTISE AND KNOW-HOW

- Elasticity theory
- Thin-walled beam theory
- Thin-walled beam structures
- Ship structures
- Wind turbine support structures
- Composite materials

- Plasticity theory
- Elasto-plastic constitutive modelling of orthotropic materials (sheet metals and additively manufactured metal components)
- Bayesian parameter estimation for constitutive and mathematical models
- Structural integrity and strength assessment
- Model uncertainty quantification
- Reliability model selection and assessment

3. RESEARCH INFRASTRUCTURE

Laboratories

- Mechanics Laboratory (setting up)
- Hydraulic and Pneumatic Systems Laboratory

4. KEY PROJECTS AND REFERENCES

Selected Projects

- IRI S3 – Development of Lightweight Polymeric Vehicle Body Components for Improved Energy Efficiency
- Deplanation and Distortion of Thin-Walled Cross-Sections
- Structural Strength Verification of the KPS-450-3-200 Traffic Sign Cantilever Structure

Selected Publications

- Andrade, D., Cvitanić, V., da Silva, L.S., & Rodrigues, D. (2025). Stress and strain anisotropy of CMT-WAAM 316LSi stainless steel: Characterisation and modelling. *Construction and Building Materials*, 493, 143274.
- Perišić, S., Barle, J., Tomac, I., & Đukić, P. (2024). Automatic damping estimation via bootstrap technique and Bayesian analysis for mechanical system condition monitoring. *Mechanical Systems and Signal Processing*.
- Vukasović, M., & Pavazza, R. (2021). Flexural analysis of thin-walled laminated composite beams with arbitrary open sections and shear influence. *Mechanics of Advanced Materials and Structures*, 29, 5041–5058.
- Grubišić, V.V., Barle, J., Vlak, F., & Ban, D. (2020). Fractures on a drillship derrick: Evaluation and improvement. *Engineering Failure Analysis*, 118, 104792.
- Barle, J., Grubišić, V.D., & Vlak, F. (2011). Failure analysis of a highway sign structure and design improvement. *Engineering Failure Analysis*, 18, 1076–1084.

Awards

- Marko Vukasović – University of Split Award for Science (2018), awarded in the category of early-career researchers, research assistants, and postdoctoral researchers.

5. COLLABORATION OPPORTUNITIES

The Linear and Nonlinear Analysis of Thin-Walled Structures research group develops analytical, numerical, and experimental methods for investigating the mechanical behaviour of structures and materials. Its research activities span several interconnected areas.

The first research area focuses on the analysis of thin-walled beams and structures, including their applications in shipbuilding and energy systems. The second area is dedicated to composite materials, covering their modelling and analysis at both the micro- and macro-scale. The third research area addresses the plasticity of orthotropic materials, with particular emphasis on the characterization and constitutive modelling of the anisotropic elasto-plastic behaviour of sheet metals and metal components produced using additive manufacturing technologies. The research activities are extended to the development of advanced methods for parameter estimation in mathematical and constitutive models, model uncertainty quantification, and Bayesian model selection. The group welcomes collaboration with academic institutions, research centres, and industrial partners in areas including analytical and numerical modelling of thin-walled and composite structures, the development and numerical implementation of elasto-plastic constitutive models for orthotropic materials, and the development and application of methods for structural reliability and condition assessment, as well as parameter estimation and uncertainty quantification. The group is open to joint research projects, researcher mobility and exchange programmes, and the transfer of scientific knowledge into industrial practice.

6. CONTACT

Head of Research Group: Frane.Vlak@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR ADAPTIVE PARAMETERIZATION FOR OPTIMIZATION AND ENGINEERING NUMERICAL METHODS

Head of the Group:

Prof. Damir Vučina, PhD

<https://www.croris.hr/osobe/profil/14719?lang=en>

Scientific Field:

Engineering Sciences / Fundamental Engineering Sciences

Brief Description of the Research Group:

The group's main research areas include numerical optimization methods, geometric modeling, evolutionary algorithms, and computational fluid dynamics (CFD). Special emphasis is placed on the application and development of artificial intelligence models for data analysis, system behavior prediction, and support of the engineering design process. By integrating computational mechanics, optimization techniques, and artificial intelligence, the group develops innovative solutions to improve the efficiency, performance, and sustainability of engineering processes and products.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Igor Pehnec, PhD
- Assoc. Prof. Milan Ćurković, PhD
- Assoc. Prof. Ivo Marinić-Kragić, PhD

Other faculty researchers:

- Luka Nikolić, MEng

2. EXPERTISE AND KNOW-HOW

- Numerical optimization methods
- Geometric modeling
- Evolutionary algorithms
- Computational fluid dynamics (CFD)
- Application of existing and development of novel artificial intelligence models

3. RESEARCH INFRASTRUCTURE

Laboratories

- Laboratory for Optimization and Design
- Rapid Prototyping Laboratory
- Ad hoc Wind Tunnel for VAWT Analysis
- CFD Analysis Laboratory

- Laboratory for Numerical Modeling and Optimization
- Laboratory for Fluid Mechanics and Hydraulic Systems
- Computational Fluid Dynamics Laboratory

Equipment

- High-accuracy and high-precision 3D scanners (GOM ATOS I and GOM ATOS COMPACT 8), Prusa and Modix 120X 3D printers, Proxxon FF 500 CNC Micro Mill, High-performance workstations and graphics stations
- Hydraulic machinery system (circulation pumps, fans, filters, etc.), Various measuring instruments (pressure measurement, velocity measurement, hot-wire anemometry, etc.)

Advanced Computing Resources

- Intel Xeon server (2 × 14 cores, 256 GB RAM)
- Intel Xeon server (2 × 16 cores, 260 GB RAM) equipped with an NVIDIA A100 GPU
- Numerical optimization computing cluster with approximately 20 computers (Intel i7, 8 cores, 32 GB RAM each)

4. KEY PROJECTS AND REFERENCES

- HRZZ 2013: Adaptive Parameterization of Variable 3D Geometries for Shape Optimization and Meshless Numerical Modeling
- HRZZ 2018: Evolutionary Shape Synthesis with Integral and Partitioned Phenotypes, Dynamic Parameterization, and Meshless Modeling
- HRZZ 2022: Numerical Synthesis of 3D Shapes Using Advanced Geometry Parameterization, Experimental Validation, and Feedback Adaptation of Numerical Models
- HRZZ 2025: Estimation of Blood Glucose Levels in Individuals with Type 1 Diabetes from Facial Photographs and 3D Facial Scans Using Machine Learning

5. COLLABORATION OPPORTUNITIES

Damir Vučina: Head of the Research Group.

Milan Ćurković: Collaboration opportunities include geometric modeling, shape optimization, 2D and 3D data processing, computer vision, and machine learning. Particular emphasis is placed on developing methods for 3D reconstruction, geometric analysis, and system condition assessment based on image and geometric data, with applications in medicine, industry, and cultural heritage.

Ivo Marinić-Kragić: Research interests include numerical analysis and engineering optimization in computational fluid dynamics (CFD), structural static and dynamic analysis, thermal analysis, energy management in microgrid systems (photovoltaic, battery, and hybrid systems), and engineering applications of machine learning.

6. CONTACT

Head of Research Group: Damir.Vucina@fesb.hr

General Contact: projekti@fesb.hr

GROUP FOR FILOLOGICAL RESEARCH (FILIST)

Head of the Group:

Prof. Nina Sirković, PhD

<https://www.croris.hr/osobe/profil/28396?lang=en>

Scientific Fields:

Humanities – Philology

Brief Description of the Research Group:

Particular emphasis is placed on the concept of time in intercultural communication and impact on the effectiveness of interaction among members of different cultures. The group also focuses on pragmatic competence in a foreign language, i.e. the ability to use language appropriately in different communicative situations. In addition, the application of artificial intelligence in students' work is explored, particularly as a tool for learning, research, work organization, and the development of academic skills.

1. RESEARCH TEAM

Faculty members in teaching and research positions:

- Assoc. Prof. Daniela Matić, PhD

Other faculty researchers:

- Mira Braović Plavša, Senior Lecturer, PhD.

2. EXPERTISE AND KNOW-HOW

- Nonverbal communication as a means of improving general communication skills
- The concept of time in intercultural communication
- Pragmatic competence in a foreign language
- The use of artificial intelligence in student's work

3. RESEARCH INFRASTRUCTURE

Laboratories

Equipment

4. KEY PROJECTS AND REFERENCES

5. COLLABORATION OPPORTUNITIES

6. CONTACT

Head of Research Group: nina.sirkovic@fesb.hr

General Contact: projekti@fesb.hr