MOBILITY

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HEI4Future

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Aeroespace Technologies group (GTA)

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Alejandro Camanzo Mariño
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Guillermo Rey González
Uxía García Luis

Research lines

- Space systems: systems engineering, communications, ground segment, operations and payloads.
- Platform and testing: study, development, design, experimentation and testing, manufacturing and operations of space vehicle platform systems and subsystems.
- Aeronautical systems: systems embedded in aeronautical systems of manned and unmanned aerial vehicles, real-time control system technologies, efficient propulsion systems, experimental aerodynamics.

Services

- Space mission definition, design, fabrication, launch and operation.
- UAV missions definition, design, fabrication and operation.
- Systems engineering.
- Space tests campaign: thermal vacuum, vibration, ADCS.
- Aeronautics test: wind tunnel.
- Space optical design.
- Classical and laser satellite communications.

Keywords

Space, thermal analysis and design, mechanical analysis and design, aeronautic, mission definition, constellation, environmental tests, UAV, real-time control system, aerodynamics.

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Efficient and Digital Engineering (EN.EDI)

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Miguel Ángel Silva Ucha

Diego Silva Muñiz

Research lines

- Industrial digitization. Complex systems of digital integration of industrial services (production control, traceability, maintenance, etc.).
- Systems engineering and industrial informatics.
- Control of axes and non-conventional robotics.
- Advanced industrial machinery automation.
- Automation of handling, logistics and industrial production systems.
- Development of standards for industrial automation.
- Industrial security.
- Renewable energies: simulation and integration in electrical networks.
- Electric power networks: planning, analysis, control and protection.
- Supply quality.
- Evaluation of energy efficiency in facilities.
- Energy efficiency systems.

Services

- Design of energy storage systems.
- Energy evaluation of load systems and their impact on power quality.
- Design and implementation of automated IT tools for business digitization: web environments, IIoT, data processing, data extraction.
- Simulation of industrial processes and systems: warehousing, intralogistics, etc.
- Design of new configurations in advanced machinery: special robots, customized machine tools etc.
- Design and implementation of control systems: industrial automation.

Keywords

Industrial digitization, industrial automation, robotics and mechatronics, energy, efficiency, renewable energy.

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Knowledge Organization (OE7)

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Roberto Chico Tato
María Dolores Docampo Diéguez

Research lines

- Business competitiveness and regional development.
- Industrial marketing: value creation and market solutions.
- Global value chains.
- Corporate strategy: production, marketing, logistics, finance.
- Innovation ecosystems and new business models.
- Industrial networks.
- Valorisation of intangible heritage.
- Industries of interest: mobility and automotive, food processing industry and tourism.

Services

- Deployment of studies on business, sectoral or regional competitiveness.
- Analysis and support for the development of industrial or science networks.
- Elaboration of sectoral strategic plans.
- Analysis of capabilities in the automotive industry, and the future of mobility.
- Trend and foresight studies for companies in the food, mobility and tourism sectors.
- Application and training in the use of quantitative methods based on the R statistical package.

Keywords

Competitiveness, industrial marketing, global value chain, innovation ecosystem, new business models, mobility, food, tourism.

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Digital Communications and Instrumentation (TE3)

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Research lines

- Electronic instrumentation systems.
- Sensor networks. Internet of things (IoT).
- Software defined radio systems.
- Radio communications.
- Radio channel modelling and tropospheric effects.
- Field buses and industrial communications.
- Automated test equipment.
- Embedded processors and programmable logic devices.

Services

- Physical systems measurement with sensors or actuators.
- Design and implementation of automated measurement systems with LabVIEW.
- Design and implementation of software defined radio devices.
- Design and assembly of satellite receivers.
- Study and modelling of the radio channel.
- Design and implementation of test benches using automated test equipment (ATE).
- Courses on radio measurements for different systems and applications.
- Courses on visual programming and data acquisition with LabVIEW.
- Courses on embedded processors with FPGAs and SoCs.

Keywords

Instrumentation, distributed sensor networks (DSN), IoT, IIoT, software defined radio (SDR), radio communications, automated test equipment (ATE), LabVIEW, field buses, embedded systems (SoC and FPGA).

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Network Laboratory (ET3)

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Research lines

- Data networks energy efficiency.
- Green networking.
- IoT networks.
- Performance analysis.
- Application of social networks, informal learning and gamification in education and knowledge management.
- Information-centric networks.
- Satellite networks.

Services

- Training in computer network technologies.
- Design, deployment and optimization of data networks (operators, data centers, corporate networks, content providers etc.).
    - Virtualization and orchestration of network resources and services, security audits, performance analysis, etc.
- Design and implementation of corporate platforms for training, group work and knowledge management.
- Design of gamification-based solutions for multiple fields (training, marketing, health, knowledge management etc.).
- Design and development of complete IoT solutions, including the deployment of sensor networks.
- Design and development of big bata solutions: data acquisition systems, pre-processing and processing of large amounts of data, deep data analysis.

Keywords

Ethernet, 5G, IoT, gamification, ICN, MAC, LEO.

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Organization Engineering (OE2)

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Research lines

- Logistics systems design and supply chain sustainable management, with special relevance in sustainable transport management.
- Continuous improvement, lean manufacturing and personnel participation systems.
- Management systems development and integration (quality, environment, risk prevention).
- Sustainable logistics design of container and packaging.

Services

Transfer and research projects.

Keywords

Logistics, lean, continuous improvement.

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Signal Processing in Communications Group - GPSC (SC10)

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Research lines

- Multimedia security.
- Multimedia forensics.
- Digital watermarking.
- Privacy enhancing technologies.
- Signal processing in the encrypted domain.
- Postquantum cryptography.
- Federated learning.
- Digital communications.
- Channel estimation.
- Cognitive radio.
- Satellite communications.
- Efficiency improvement in digital communications.
- Adaptive signal processing.
- Full duplex communications.
- Sensor networks.
- MmWave and wideband channel.
- Hybrid ADC Massive MIMO.
- User positioning and mobility.
- Integrated Access+Backhaul (IAB).
- Cross-layer Scheduling/Slicing.
- Full-stack network simulation.
- IoT, smart grid/city and CPS.

Services

- Digital baseband design.
- Interference cancellation schemes.
- Communication system optimization and measurement.
- Full-Stack Network Simulation.
- Image and video forensic analysis.
- Steganalysis.

Keywords

Multimedia security, forensics, anonymity, privacy, encryption, federated learning, watermarking, digital communications, radio communications, satellites, repeaters, relays, adaptive algorithms, interference cancellation, estimation and detection, 5G, massive MIMO.

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Research lines

- Mechanical engineering, mechanical design.
- Product engineering.
- Application to mechanical engineering of 2D/3D CAD techniques, virtual reality, extended reality.
- Linear and Nonlinear FEM. Static and dynamic.
- Multy-body System (MBS). Impact. Vibrations.
- Thermal-Structural CFD BEM. FSI. Electromagnetism.
- Autonomous drones for inspection.
- Industrial automation.
- Hydraulic systems.
- Pneumatic systems.
- Electric systems.
- Electronic systems.
- Mechatronic systems

Services

- Mechanical design and calculation.
- Dynamic systems: mechanical calculation of systems in explicit and implicit dynamics.
- Energy production: design of energy production mechanisms and equipment using renewable energy.
- Mechatronics design of custom equipment.
- Design and commissioning of autonomous inspection systems.
- CIMAclas. Historical vehicle cataloging laboratory accredited by the Xunta de Galicia.

Keywords

Mechanical design, mechatronic design, product engineering, FEM calculations, vibrations, energy production, composite materials, hyperelastic materials, linear viscoelastic materials, nonlinear viscoelastic materials, prosthetics, carbon fiber, machining, automotive, classic vehicle cataloging, numerical calculation, virtual trials and safety in vehicles, electric vehicles, VR, XR.
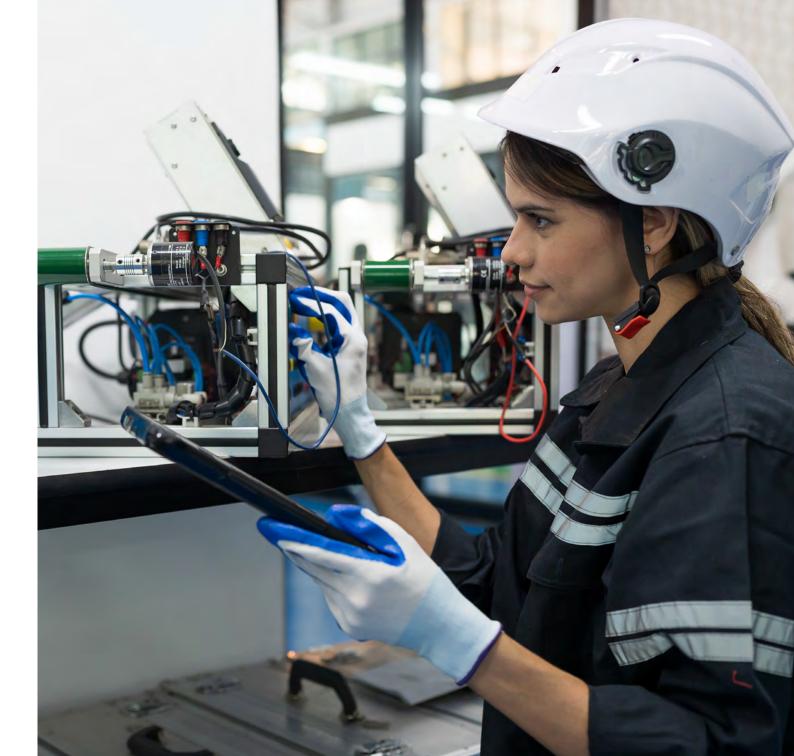
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Research lines

- Innovation and operational excellence.
    - Strategy: diagnosis and dashboards for business strategies and public policies.
    - Operational excellence: methodologies and tools for organizational transformation.
    - Industry 4.0: integration of ICTs and operational excellence practices.
    - Sustainability: decarbonization and dematerialization of industrial and logistics processes.
    - Social innovation: initiatives to boost and measure new services for society (social inclusion, gender equality, environment).
- Energy and environmental economy.
    - Energy markets: demand, efficiency, regulation and policies.
    - Climate change: environmental policies and intervention instruments.
    - Taxation: energy taxation, energy efficiency, energy security.
    - Mobility: social costs, congestion, regulation, taxation, transition to new scenarios.

Services

- Project management.
- Economic studies.
- Cost-benefit analysis.
- Innovation measurement systems.
- Research projects for technology centers and companies in the fields of energy, food, pharmaceutical industry, services, fishing, construction and automotive.

Keywords

Innovation and operational excellence: strategy, operational excellence, continuous improvement, industry 4.0, lean, sustainability, social innovation, energy and environmental economics: energy markets, climate change, taxation, mobility.

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Group of Researchers in Empirical Economics - GRIEE (EA10)

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Research lines

- Health economics: economic valuation, healthcare demand models, waiting list management, dependency assessment.
- Family economy: fertility and labor decisions, non-working time allocation models.
- Industrial economy: R&D, technical change, competition, human capital, productivity, business strategies.
- Regional economy and economic growth.

Services

- Analysis of the effectiveness of medical treatments.
  - Evaluate the effectiveness of medical treatments. Sample size selection. Random selection of the treatment group and the control group. Effect estimation using econometric techniques: differences in differences (diff in diff).
- Public policies evaluation.
- Analysis of business strategies effectiveness.
  - Analysis and estimation of demand elasticity.
  - What response does the consumer have to an offer (price reduction)?
- Equality analysis. Wage gap measurement companies and/or sectors.
  - Analyse and measure the wage gap in companies or groups of companies.
  - Support in the analysis of salary and employment data of companies for the development and monitoring of equality plans.
  - Reports on wage gaps in economic sectors.
  - Organize databases and obtain descriptive statistics.

- Data analysis with Python. Courses and advice.
  - Guide in data analysis for economic decision-making.
  - Data analysis courses with Python.
- Economic analysis in defence of competition.
  - Judicial experts in antitrust cases.
  - Financial support in antitrust cases: relevant market study, calculation of market shares, calculation of concentration indices.
  - Sector study from the point of view of competition.
- Preparation of reports and business competitiveness indicators.
  - Sectoral indices of business competitiveness focused on exports.
  - Sector study from the point of view of competition.

Keywords

R&D, business strategies, health.

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Research lines

- Energy optimization of thermal and electrical propulsion systems.
- New low carbon footprint fuels.
- Modelling, simulation, and optimization of thermal processes.
- Vehicle aerodynamics.
- Study of lubrication through ultralow viscosity oils.
- Anti-pollution systems for engines and thermal generators.
- Heat transfer with phase change (boiling).
- Residual heat recovery systems for automotive (Rankine, TEG, etc.).
- Cabin climate control and overall vehicle thermal management.
- Use of tools for in-situ measurement of vehicle interest flows.
- Multiscale modelling of processes and systems.
- Application of Machine Learning tools for process optimization.
- Life Cycle Assessment (LCA).
- Energy storage and its thermal management.

Services

- Modelling and optimization of thermal equipment and processes.
- Engine test-cell testing of new fuels.
- Combustion systems (simulation and testing).
- Study of anti-pollution systems for automotive engines.
- Study of cooling of electronic components and systems. Residual heat recovery systems for automotive.
- CFD simulation of processes and systems.
- 1-D simulation of systems (digital twin).
- Application of Machine Learning techniques to experimental databases.
- Design of methodologies for process and system optimization.
- Prototype manufacturing.

Keywords

Thermal processes, fluids, CFD, heat exchangers, aerodynamics, new fuels, digital twin, Machine Learning.

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Antenas, Radar e Comunicacións Ópticas (SC7)

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Research lines

- Millimeter wave sensing systems for (static or on-the-move) security imaging.
- Analysis and synthesis of antennas (multireflector, reflector + reflectarrays transmitarrays, reconfigurable) for scanning or satellite applications.
- Characterization, identification or non-destructive detection of materials and substances by THz spectroscopy.
- Quantum communication.
- Quantum cryptography.
- Quantum information.
- Fast integral-equation methods and supercomputing techniques applied to computational electromagnetics.
- Parallel High Performance Computing (HPC).
- Electromagnetic compatibility (EMC), simulation and measurement. Electromagnetic interferences between systems (EMI), radiations hazards (EMR).
- Design of antennas and matching networks on board of real platforms (ships, airplanes etc.) with complex environments.
- Electromagnetic simulation of advanced artificial materials (metamaterials) and complex plasmonic systems (coloids of nanoparticles, nano-antenas etc.).
- Surface-enhanced Raman spectroscopy (SERS) and other nanoplasmonic biosensing and biomedicine applications.
- Electronc Warfare. Ship signature management (measurement, simulation and control), both radar signature and infrared (IR) signature.
- Radar Cross Section (RCS), simulation, measurement and control.
- Radar imaging.
- Synthetic Aperture Radar (SAR), Inverse Synthetic Aperture Radar (ISAR), tomography, etc.
- Automotive radar systems.
- Application of electromagnetic fields to food freezing technologies.
- Cell Alive system (CAS).
- Integrated photonics.
- Satellites.
- Civil Security.

Services

- Design and characterization of 3D high-resolution radar systems to obtain on-the-move imaging.
- Electromagnetic consulting: analysis and synthesis of reflector antenna systems, electromagnetic compatibility.
- THz spectroscopy: estimation of electrical parameters: refractive index, absorption coefficient), characterization of transmission channels or high-resolution antennas; THz imaging.
- Simulation of the electromagnetic behaviour of platforms with many radiating systems (warships, aircraft, ground vehicles, etc.). This process may include design and optimization of the location of antennas; simulation, reduction and control of the radar section (SER/RCS); or the complete modelling of E3 problems (Electromagnetic Environmental Effects). E3 encompasses fundamental disciplines such as electromagnetic compatibility (EMC), electromagnetic interference (EMI), or dangerous radiations (EMR/RADHAZ) both for personnel (HERP) as well as for weapons (HERO) and fuels (HERF).
- Pre-certification of systems to verify compliance with Electromagnetic Compatibility (EMC/EMI) regulations.
- Electromagnetic simulation of advanced metamaterials and frequency selective surfaces (FSS), applied to low observable radar.
- Simulation of complex plasmonic systems (nanoparticle colloids, nano-antennas, etc.). Surface enhanced simulations, Raman spectroscopy (SERS) and other applications of nanoplasmonics in biomedicine and biosensing.
- Design and manufacture of radar and infrared signature measurement systems, and diagnostic and training systems for electronic warfare equipment.
- Cybersecurity of systems and network virtualization on board ships or complex environments, digital twins, artificial intelligence, 5G networks etc.
- Miniaturization of HF antennas on military ships.
- Design of automotive radar systems.
- Application of electromagnetic fields to food freezing techniques. CAS freezing system.
- Quantum cryptography systems security analysis.
- Quantum technologies consulting.
- Electromagnetic measurements:
    - Up to 24GHz antennas characterization.
    - Electromagnetic compatibility measurements and tests (radiated emissions/immunity and conducted emissions) according to the test conditions of the UNE-EN 61000 and CISPR16 standards, in low-consumption single-phase systems.
    - Coverage measurements and analysis of signals in wireless communications.
    - Electromagnetic signature measurement for ships, land, and air vehicles; both radar signature (RCS, ISAR, SAR, tomography etc.) and infrared signature (IR).
- Training through the organization of various courses, seminars and conferences related to electromagnetic radiation (interaction with living beings, materials or complex structures; electromagnetic compatibility).

Keywords

Electromagnetic fields, radiofrequency, electromagnetic compatibility, electromagnetic simulation, spectrometry, security, instrumental demonstrator, signal processing, communications, calibration, signal measurement and emulation, integrated services system, monostatic, multistatic. Antennas, scanning antennas, reflector antennas, naval antennas, radiation pattern, antenna miniaturization. Radar systems, radar imaging, millimeter wave scanners, detection of improvised explosive devices, radar equivalent section, radar signature, infrared signature, ground penetrating radar. Quantum communications, quantum cryptography, quantum key distribution, communications security. Biosensing, biomedicine. Electronic warfare, radar signature, infrared signature. Remotely piloted aircraft, drone.

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Computer Systems and Software - GEAC (SI1)

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Research lines

- Industrial informatics.
- Information systems.
- Human-computer interaction (HCI).
- Computer assisted teaching.

Services

- Development of secure Industrial Information Systems.
- E-learning, real, virtual and mixed.

Keywords

Industrial informatics, cybersecurity, information systems, HCI (Human-computer interaction), e-learning.

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Information & Computing Lab (ICLAB)

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Research lines

- Privacy and security in distributed and collaborative DL/ML (Deep Learning/Machine Learning).
- Increamental learning and xAI (eXplainable Artificial Intelligence) in distributed computing.
- Early outlier detection applying data analysis techniques in different fields: crowd sensing, smart grids, HPCD systems etc.
- IoT (Internet of Things): protocols and distributed solutions on the edge (Edge/Fog/Mist computing).
- QKD (Quantum Key Distribution) protocols.

Services

- ML/DL (Deep Learning/Machine Learning) solutions for pattern inference and early detection of anomalies (sensing networks, HPC, etc.).
- Solutions for IoT (Internet of Things) in industrial environments.
- AI (Artificial Intelligence) solutions for IoT environments: distributed computing of Machine Learning (ML) algorithms.
- Micro-learning solutions for informal learning, awareness and corporate environments: solutions based on bots (conversational assistants) and on forgetting curves.

Keywords

IoT, Machine Learning (ML), Deep Learning (DL), edge/fog/mist computing, distributed computing, ciber-crime, privacy, federated learning, xAI, conversational bots, QKD (Quantum Key Distribution), e-learning.

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Corrosion and materials engineering – ENCOMAT (CI11)

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Sara Valverde Pérez

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Enrique Rodríguez Castro

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Research lines

- Coating for protection against corrosion (organic and inorganic coating, etc.).
- Superficial modification for anti-corrosion properties improvement (ionic implantation, laser reflow etc.).
- Electrochemical corrosion (corrosion of reinforced concrete and other structural materials, oxides for batteries).
- Electrodes development for ion-lithium batteries.

Services

- *E-Life.*
- Project in collaboration with AIMEN and VMS Automotive for the characterization of Li-ion batteries under different operating conditions.
- Sustainable transport infrastructure in the Atlantic Area (DURATINET).
- Development of new conversion coatings with self-repairing properties for corrosion protection of high strength steels.

- Aluminium alloys reinforced with nanoparticles for sustainable transport: Mechanical alloy, extrusion, and welding by beaten friction.
- Aluminium-based materials selectively reinforced by the beaten friction technique: tribological properties and corrosion resistance.
- Development of new ecological building materials based on geopolymers obtained from microsilica as raw material (eGEO).
- Aluminium hot forging techniques for manufacturing large structural components for automotive.
- Selective electrochemical recovery of minor elements from scraps of tin-based alloys.
- Analysis of the state of fermentation of bread doughs for rheological control, automation of the cutting process and routing of bar grinding.
- Characterization of shape memory steels for structural applications.
- Design and fabrication of anodes by additive manufacturing technique, used in cathodic protection.

Keywords

Corrosion, electrochemistry, materials, batteries, concrete, wear, composite materials, friction welding and processing, additive manufacturing, shape memory materials.
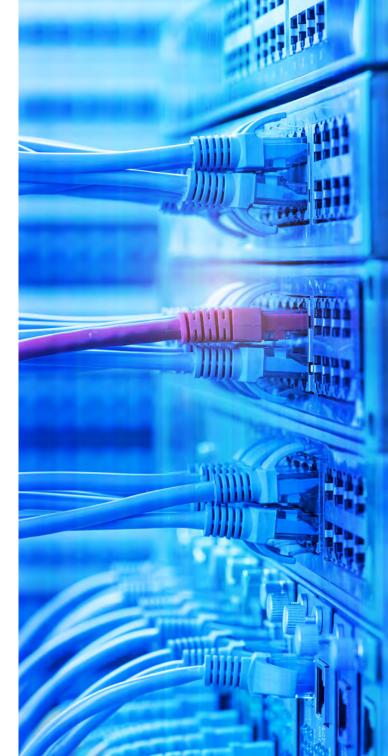
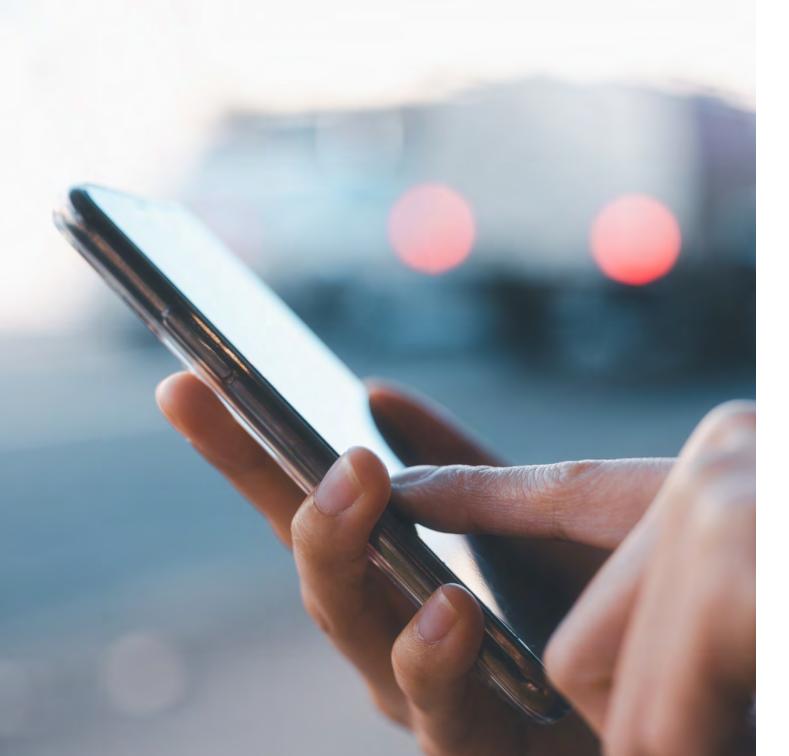## Contact

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Research lines

- Intelligent networks.
- 5G communications networks.
- Data analysis.
- Wireless networks.
- Intelligent services.

Services

- 5G communication networks and beyond: Mobile Edge Computing (MEC), cell-less networks, ultradense networks, zero-touch networking, intent-based networking, SDN, NFV, virtualization and orchestration of network resources, virtualization and orchestration of services, protocol design, network optimization, private networks, industrial networks, tactical networks.
- Embedded systems: sensors and intelligent systems for networked autonomous vehicles.
- Multimedia distribution technologies: scalable protocols, intelligent network services.
- Data analytics: natural language processing, natural language generation, automatic explicability, conversational technologies, network data analytics, service data analytics, social media analytics, Industry 4.0 data analytics.
- Wireless networks: intelligent access networks, cooperative networks, cognitive networks.
- Artificial intelligence technologies as a solution of large-scale problems.
- Agent technologies.

Keywords

5G, IoT, Industry 4 0, intelligent networks, autonomous vehicles, big data, natural language processing, data analytics, wireless networks, intelligent networked services, cyberphysical systems.

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Research lines

- Industry, energy and environment.
- Infrastructures.
- Construction and architecture.
- Intelligent cities and spaces.
- Geo-computer science.
- Teledetection.
- Unmanned aerial vehicles.

Services

- Smart cities.
- 3D models.
- Digitization.
- UAVs.
- NDTs.

Keywords

Geoinformatics, geospatial intelligence, smart cities, resilient infraestrutures, 3D mobile mapping.

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Research lines

- Aerospace and transportation systems.
    - Advanced mobility.
    - Logistics networks.
    - Maintenance and resilience of infrastructure.
    - Intelligent transportation systems.
    - Geoinformation.

Services

- Transportation engineering. Intelligent systems.
- Infrastructure resilience. Maintenance and inspection.
- Mobility.
- Observation systems.
- Navigation systems.
- Unmanned aircraft systems.
- Advanced computing and artificial intelligence (AI).
- Numerical modelling.

Keywords

Transport, mobility, remote sensing, navigation, infrastructures, unmanned aircraft systems, observation satellites, geoinformation.

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