The keys of our research and knowledge transfer are:

• Alignment of our technological capabilities with the needs of our industry
• Pursuit of scientific and technological excellence in knowledge generation
• Effective knowledge transfer to the industry by a collaborative research model
Research Groups

**MATериалы, технология и производственные процессы**
- Полимеры и композиты
- Высокопроизводительная механика
- Высокоточные процесссы формования

**Системы и информационные системы**
- Анализ данных и кибербезопасность
- Программное обеспечение и системное инжиниринг
- Теория сигналов и коммуникации
- Робототехника и автоматизация

**Механическое поведение и дизайн продукции**
- Структурные механика и дизайн
- Акустик и вибрации
- Флюидная механика
- Технологии поверхности

**Энергетика**
- Системы и управление электрической энергией
- Системы тяги и генерации электрической энергии
- Энергоаккумулирование

**Инновация и управление процессами**
- Управление
- Инновации и предпринимательство
- Инновации в индустриальном дизайне

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“Fagor Arrasate, Koniker and Mondragon University have a long term research collaboration agreement since 2010 that covers several strategic research areas for the company.”

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Dani García  
Fagor Arrasate S. Coop.  
Technical and Innovation Director
The team researches INTELLIGENT SYSTEMS applied to improve actual industrial processes, bridging the gap between manufacturing and ICT, contributes to INFORMATION AND COMMUNICATION SECURITY, specially focusing to Operational Cybersecurity, and contributes to the HEALTH industry through DATA ANALYTICS.
Research Lines

INTELLIGENT SYSTEMS FOR ADVANCED MANUFACTURING

The Group works towards providing more intelligence to manufacturing processes, through real time monitoring and prediction of asset failures (streaming Big Data techniques and predictive algorithms in time series), Predictive/Proactive maintenance of manufacturing assets, parts inspection (with artificial vision and acoustic), and collaborative robots [in cooperation with intelligent automation group]

INTELLIGENT SYSTEMS FOR INDUSTRIAL PROCESSES

Focuses its activity on improving processes where automation (metal processing, water treatment, etc.) is involved. It makes use of information at the process level, and it seeks the optimization of parameters, and the detection of anomalies in the process.

INTELLIGENT SYSTEMS FOR HEALTH INDUSTRY

Focuses on the analysis of data to help decision-making and improve the quality of life of both patients and health professionals. Pattern recognition and human behavior prediction techniques are used to help prevent disease, or improve quality of life. Heterogeneous data sources are used following the Big Data paradigm, being the medical history, personal data or environmental data some examples of this.

INFORMATION AND COMMUNICATION SECURITY

We contribute to Anomaly Detection Systems to Industrial Control Systems. We also research in understanding, learning and simplifying cybersecurity information by means of intelligent systems, such as correlation of security events, honeypots/deception systems, social network analysis, mobile device and network data analysis, and vulnerability analysis of embedded/industrial systems.

Founding Members of the Network of Excelence Research Centres in Cibersecurity

Big Data Value Association (BDVA) full members
EQUIPMENT

ASSERT-MU Lab
The laboratory is structured around the network emulation software Emulab. It allows an emulation of different network topologies and virtual devices in a dynamic, secure and rigorous manner. Therefore, the laboratory is capable of testing networks ranging from few to hundreds of nodes easily, uploading images prepared in advance of the devices connected to the network and automatically setting the communication devices to achieve the desired arrangement.

If you want to evaluate a topology redesign of your IT or industrial network, comparing different designs, test new technologies, before putting the system into production, ASSERT-MU can do safely and in a flexible way.

PROJECTS

MANTIS
Mantis is an Industry 4.0 related European Project coordinated by the group. The aim of MANTIS is to design and develop a Reference Architecture based on industrial maintenance services in the Cloud.
http://www.mantis-project.eu/

MC-SUITE
MC-SUITE is a H2020 project of the Factories of the Future call, where the groups has a fundamental role of providing technology to secure the entire flow of data from the machine to the Cloud
http://www.mc-suite.eu/
We focus our research in different aspects of the development of Software and Systems. We apply our knowledge in complex, highly configurable and distributed systems with real time constraints which need a multi-disciplinary approach and require interoperability in the development.
Research Areas

Automatic parameterization of highly configurable systems and simulation infrastructure.

Search based algorithms to select and prioritize test cases for a system configuration.

Delta Modelling.

Reuse and safety.

Model-based analysis with variability.

Tool integration using OSLC standard.

Co-simulation: Functional Mock-up Interface.

Distributed simulation infrastructure.

Model driven reengineering and evolution

Semantic Web technologies and data structures. Linked data from the perspective of open systems (Open source and Open data).

With this technology enriched structures could be provided to:
- Facilitate to search contents and services.
- Create intelligent agents for process automatization.
- Extract, process and store knowledge (Knowledge management).
- Integrate heterogeneous systems.
- Compose complex systems.
- Filter information
- Enable semantic processing by machines
- Standardize vocabularies

Specialization in three key areas in the Design and Development of Distributed Control Systems: Reliability, Predictability and Control Optimization and Scheduling.

Moreover, the development of this research is oriented to embedded systems with reliability and real-time requirements across all the components of a distributed system, such as: communications, operating systems, and middleware.

We apply our knowledge in IoT-enabled smart Cyber Physical Systems, which drive the innovation in Smart Cities, Smart Buildings, Smart Homes and Smart Factories.
Research and Industrial Projects

RENOVATES
Rennovates is a holistic systemic deep renovation concept using smart services and developing smart energy-based communities resulting in energy-neutral housing – up to and beyond Zero Net Energy – by reducing energy consumption and maximizing the use of renewable energy.

SMARTENCITY
Develop smart solutions on Mobility, Energy saving and ICTs for the improvement of citizens’ quality of life.

ACCELERATE
Accelerate is a platform for the acceleration of go-to-market in the ICT-industry.

CPS-BUDI
Integration of building domain specific tools and standards for modeling and simulation with cyber-physical systems design and simulation tools.

Industrial Projects
- Technological advice & Training
- System analysis and Design
- Prototypes
- Reengineering and refactoring
- Methodology improvement & deployment
Wired and wireless communications
Artificial vision and robotics
Sensors and process control
Design, simulation and implementation of signal processing systems
Research areas

COMMUNICATIONS
- Communication protocols.
- Wireless communications.
- Real-time communications.
- Digital television.
- Multimedia networks.
- Vehicular communications.

ARTIFICIAL VISION AND ROBOTICS
- Metrology 2D / 3D surface
- Characterization robotics
- Processing acceleration
- Advanced manufacturing
- Medical images

SENSORS AND PROCESS CONTROL
- Development and integration of sensors and actuators
- Virtual sensing Signal
- Processing applied to monitoring
- Process monitoring
- Advanced manufacturing
- Process control
- Wireless sensors
- Acoustic systems and ultrasonic inspection

IMPLEMENTATION OF SIGNAL PROCESSING SYSTEMS
- FPGAs
- Microprocessors, DSPs
- Real-time operating system
- Embedded Linux
- Codesign Hw / Sw
- High-level design:
  - System Generator
  - HDL Coder
  - SystemC
- Reliable electronic systems

High-level design:
- System Generator
- HDL Coder
- SystemC

Reliable electronic systems
2014
2015

10 PhD Students

8 PhD projects

20 Private research contracts

4 Engineers

2 Book chapters

5 patents

650 000 € Budget

RELEVANT PROJECTS

OPTIMUS: On-line partial-discharge tracing using an improved monitoring and ubiquitous solution.

SOCFLEX: Flexible on-chip system for intelligent processing of tables and services in new generation header equipment.


COWITRACC: Cognitive wireless transceivers for critical communications.

AIRHEM: Health monitoring for intelligent transport systems.

MANTIS: Cyber physical system based proactive collaborative maintenance.

SIMOVE: Control system of indoor motor vehicle.

GREENFRG: Development of a flexible inspection cell for forged components and intelligent human-machine communication language.

NEOBIO: New products for reproductive and prenatal health.

FACILITIES

Telecommunications Lab
Signal Processing Lab
Radiofrequency Lab
Embedded Systems Lab

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Main goal: “To research on adaptive production systems”
It needs to be:
• Scalable
• Cost efficient
• Automatize part
• Automatize the automatization

2017 IEEE International Workshop of Electronics, Control, Measurement, Signals and their application to Mechatronics (ECMSM)
Research topics

Image processing
- 2D / 3D Metrology
- Quality inspection
- Medical
- Embedded
- Deep learning
- Camera calibration

Robotics
- High precision robotics
- Human-robot interface
- Collaborative robotics
- Automated inspection
- Skill-based robot programming

Intelligent automation
- Process optimization
- Predictive maintenance
- Autonomous systems
- Self-learning systems

Process Automation
- Sensors & Monitoring
- Industrial control systems (CNC, PLC, PC embedded, SCADA)
- Motion control
- Machine safety

Industrial Communications
- Industrial protocols / Fieldbus: (Profibus, EtherCAT, Profinet, …)
- Connectivity
  (OPC-UA, MTConnect)
- Internet of Things

[Maestro, 2016]

[Saenz de Argandoña, 2009]

[Maestro, 2016]

[Zuriarrain, 2012]

[Legarda, 2016]
EQUIPMENT

Signal and image processing laboratory

Automation and Robotics laboratory

RELEVANT PROJECTS

**COROBOFLEX** “Desarrollo y evaluación de técnicas y estrategias de diseño de sistemas de inspección precisos basados en robots colaborativos fiables”

**GREENFRG**: Desarrollo de una célula flexible de inspección de componentes forjados y un lenguaje de comunicación hombre máquina inteligente.

**GRUPOS SISI** *Member of the "Intelligent Systems for Industrial Systems" research group recognized by the Basque Government*

**PANORAMIX** “Sistema para reconstrucción tridimensional de superficies mixtas (reflectantes y/o mates) para aplicaciones industriales y médicas”

**INMAQUENER** “Incremento del valor añadido de la máquina herramienta a través de la utilización de la monitorización, control adaptativo y métodos de control”

**ULTRAMED** “Localización, detección y modelado de arterias y venas para la asistencia y prevención de enfermedades cardiovasculares mediante ultrasonidos”

**AMIAN** “Desarrollo de un dispositivo automático para el recuento de fibras”

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**Budget 341,000 €**
The main objective is to generate and disseminate new knowledge related to the next-generation composite materials, with special emphasis on those whose energy absorbing and damage tolerant are outstanding, and are manufactured by liquid moulding techniques (RTM, WCM, infusion, pultrusion).

Our holistic approach, covering from material characterisation to process/structural simulation and experimental trials, favours the solvency to be involved in projects going from TRL1 up to TRL 6.
Research areas

**Design**
- Conceptual Design (CAD, LCA/C)
- Design for manufacturing
- Materials selection

**Materials characterisation**
- Process
- Mechanical: Tensile, Fatigue, Impact

**Optimization**
- Finite Element Analysis
- Structural
- Process

**Fast tooling (3D printing)**
- Drapeability
- RTM
- Vacuum bag

**Liquid Composite Moulding**
- Compression RTM (CRTM)
- Thermoplastic RTM (TP-RTM)
- Wet Compression Moulding (WCM)

**Process Monitoring**
- Pressure and temperature
- Electric sensor
- Fibre optic sensor
- Ultrasound sensors

**Materials characterisation**
- Curing
- Rheology
- Permeability

**Simulation**
- PAM-RTM
- PAM-FORM

**Out of die curing + Pulling by robot**
- New resins
  - Impact resistant
  - Fire resistant
  - Aesthetics
  - VOC free
- Alternative curing technology
  - Ultraviolet
  - Microwave
  - Infrared
- Contact-less monitoring technology
  - IR thermography
  - THz spectroscopy

**Robotics**
- From CAD to path programming
  - Adaptive control

**3D Pultrusion**

**Metal-Composite hybrid materials**
- Fibre-Metal-Laminates (FML)
  - Aluminium
  - Magnesium
  - Shape Memory Alloy
  - Epoxy-glass fibre
  - Organo sheets
  - Self-reinforced composites
- Processing FML
  - Infusion/VACRTM
  - Stamp forming

**Performances**
- Impact
- NVH
- Fire
- Morphing

"Outstanding composite skills for automotive industry. They are enthusiasts, rigorous, easy to communicate"

IVAN GALLEGØ
Responsible for Innovation Projects
MONDRAGON Automoción
FACILITIES

RADIUS electric injection system
- Pressure and flow control
- Flow rate 500 cc/min
- 2100 cc
- 27 bar
- 280 °C

400 t
- 800 mm/s
- 2400 mm × 1200 mm

4 t
- 200 mm/s
- Ram stroke 400 mm

Quality (density, fibre %, porosity, delamination, dry zones): SEM, C-Scan

Mechanical: Tensile, Fracture mechanics, ILSS, Impact, Fatigue, Biaxial, Digital Image Correlation, Fibre Optic Sensor

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5 PhD Students
2 European Projects
5 industrial contracts
4 PHD
350 000 € budget
9 JCR papers
8 international conferences
11 national conferences
Generating knowledge for improving machining production processes in different industrial sectors and incubation of ideas for manufacturing innovative products, through the creation of multidisciplinary teams among companies, research centres and universities.
**Research Areas**

**Study of the Machining process**
Generation of knowledge about the process of separation of removal of material using advanced experimental techniques and modelling

**Machinability**
Study of the behavior of materials in machining:
- Steels
- Titanium alloys
- Nickel-based alloys
- Foundries

**Grinding**
Selection of grinding wheels, working conditions, lubrication, etc. for the optimization of grinding

**High Speed machining / 5-axis**
Generation about high-speed machining and 5-axis for the manufacture of complex shapes

**Intelligent machining**
Application of monitoring and adaptive control to ensure efficient and consistent machining processes with the quality required

**Micro-machining**
Generation of knowledge about tools, working conditions, fasteners to improve the performance of micromachining

**Bio-machining**
Generation of knowledge about bone machining to ensure the quality of the surface obtained

**CAD CAM CNC**
Developing applications for CAD / CAM / CNC to expedite the development of machining processes

**Distortions**
Prediction of distortions caused by residual stresses stored in previous processes and during machining

**Superficial integrity and fatigue**
Study of surface integrity caused by the machining process and its behaviour in the life of components regarding fatigue

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**Micromilling machine KERN-EVO**
**Tangential grinding machine CNC GER**
**Vertical turning machine Danobat TV700**
**High-speed machining centre with 5 Axes LAGUN GVC 1000 HS**
**Profile meter ALICONA IFG4**
**FACILITIES**

- **Machining Lab**
  - Micromilling machines Kern Evo (50,000 rpm/160,000 rpm),
  - High-speed machining centres LAGUN (18,000 rpm) and Kondia (12,000 rpm)
  - Vertical CNC turning machine Danobat TV700 and Horizontal CNC turning machine Danumerik
  - Flat surface grinding machine GER
  - Broaching machines Ekin RAS
  - Equipment for the study of the machining process: Kistler dynamometers for measuring forces in turning, milling, grinding, broaching ..., accelerometers, high speed camera Photron Fastcam Ultima APX-RS-250K Monochrome, Thermographic camera Titanium 550M
  - Measurement of residual surface stresses (Hole Drilling)
  - Metrology: coordinate-measuring machine, profilometer, profilers Infinite Fucus IFG4
  - Microstructural characterization of materials: optical and electron microscopes
  - Mechanical characterization of materials: universal servohydraulic machine MTS 810 equipped with oven (100KN), universal machines INSTRON (10KN, 20KN).
  - Specific SW: Unigraphics, Abaqus, AdvantEdge, Deform...

**PROJECTS**

**DESAFIO II (RETOS COLABORACION, Spain)**
Improving the surface condition of the parts applying more productive processes, anticipating and eliminating anomalous errors through process monitoring.

**MMTech (H2020)**
Development of new manufacturing processes for titanium aluminides to reduce manufacturing costs and ensuring the surface integrity required [http://mmtech-nology.com/](http://mmtech-nology.com/)

**MCSuite (H2020)**
Development of ICT technologies for simulation and optimization of machining processes so as to increase competitiveness [http://www.mc-suite.eu/](http://www.mc-suite.eu/)

**AeroTurnMilling (Hazitek-Manunet, Europe-Regional)**
Development of the machining of turning-milling for the manufacture of aircraft components

**Emulate (MINECO, Spain)**
Characterization of materials under extreme conditions and development of machining models
The aim of the research group is the development of innovative forming processes able to produce high added value components and goods. The main activities are the casting, forging and sheet metal forming of in-house developed alloys as well as in market available ingots, billets and coils. Typical projects cover material and tribological characterization activities, process optimization using advanced FEM simulation, tool and mold design-manufacturing and final prototyping using available industrial facilities.
Research Areas

**MATERIAL CHARACTERISATION**
- Mechanical and thermo-physical properties characterisation for metal casting, forging and forming simulations

**TRIBOLOGICAL CHARACTERISATION**
- Tribological study of materials close to process condition
- Surface texturing for process optimization

**SHEET METAL FORMING AND HOT STAMPING**
- Process development for new alloys (3rd generation, AHSS, aluminium and superalloys) based on FEM
- Tool design and set-up, prototyping and final testing of components

**FORGING AND THIXOFORMING**
- Optimization of open and closed die hot forging
- Cold forging modelling and fracture detection
- Microstructural evolution prediction, die wear prediction and enhancement based on process modelling
- Thixoforging of light alloys and steel real components

**HYDROFORMING AND GAS MEDIA FORMING**
- Sheet and tube hydroforming of AHSS, Stainless steels and superalloys
- Super Plastic Forming of new aluminium and titanium alloys

**METAL CASTING**
- Sand and gravity die casting of components
- Pressure die casting of light alloys
- Investment casting of light and titanium alloys
- Vacuum Cold Crucible Melting of novel alloys for aeronautical and health applications

**ROLLING AND ROLL LEVELLING**
- Novel design of roll levelling machines
- Rolling and tempering of aluminium and steels
- Process chain simulation and study of rolling and levelling influence in subsequent forming processes
Sheets Metal Forming Facilities

- FAGOR 4000 kN servo-press
- GAMEI 1500 kN hydraulic press
- GAMEI 1500 kN mechanical press
- SCHMIDT 40 kN servo press
- Sheet and Tube Hydroforming (4000 bar)
- 100 kN punching machine
- 250 kN Biaxial testing machine
- Strip Drawing Test tribometer
- Duncal Shabel Test tribometer
- Nakajima ISO standard tester
- Hole Expansion ISO standard tester

Forging and Thixoformng Facilities

- 150 Kw EFD Induction Heating Furnace for billets
- KUKA KCR1 robot for parts handling

Casting Facilities

- GAMEI 3000 kN HP die casting machine
- NABERTHERM 11KW melting furnace
- NABERTHERM furnaces for heat treatment
- EFD induction furnace for Fe
- EFD induction furnace for Al and Mg
- SECO/WARWICK Vacuum Cold Crucible Melting machine
- TM SD-3000 3D printer for rapid prototyping of moulds

General

- CHARMILLES Wire EDM machine
- ONA Electrode EDM machine
- MITUTOYO 3D measurement machine
- PLM and ALICONA Confocal profilemeters
- ANTON PAAR MCR501 high temperature rheometer
- LINSEIS LFA 1000 Laser Flash thermal analyser
- LINSEIS L75VS1600C dilatometer
- NETZSCH high temperature DSC
- FEI (FE-SEM) Nova NanoSEM 450 microscope

Projects

The research group projects are normally industry driven and aim at developing new goods and processes ready to be used in real industrial applications including basic research tasks. Signed long term research agreements with industrial partners (e.g. Fagor Arrasate, Batz, Matrici, Alfa) allow the recruitment of students and providing turnkey solutions and PhDs to the near companies increasing their technological knowledge.
Certified as a group of excellence Class B by the Basque Government since 2013, has four strategic areas of research:

1. Component based fatigue history and Residual Stress Management (RSM)
2. Development and optimization of prototypes, systems and mechanical components
3. Advanced multi-physics simulation (FSI)
4. Computer Aided Engineering Automation (CAx)
The history of a product has a direct impact on the fatigue life of components and products. Management of residual stresses (RSM), surface integrity and control of microstructure predict and optimize product performance in sectors as demanding as aeronautics, energy, automotive, ...

One of the key strategic lines of the group is the specialization in advanced component design, mechanical systems and prototypes, through the characterization of key design variables oriented towards efficiency and optimizing performance in terms of life, wear, thermal behaviour, vibro-acoustic behaviour, etc.

Current products increasingly require the integration of different physical fields for proper modelling: phenomena such as thermomechanical behaviour or an appropriate modelling of heat transfer phenomena often require integration of mechanical, thermal, fluid or even electromagnetic physics.

Technology transfer to the company often requires a high degree of skill not always available in the company. Therefore, automation tools for transfer and implementation of such knowledge is key. In addition to developing knowledge of technical solutions aligned with the strategic lines of research, the group offers the possibility to develop tools that facilitate the transfer of knowledge to the company.
FACILITIES

Generic equipment:
- Fatigue machine MTS 810, 100 kN (-190-1400ºC)
- Hole Drilling Equipment
- Thermal imaging camera
- Mechanical characterization
- Sensors, data acquisition equipment (force, torque, strain, temperature, displacement, acceleration, ...)

Equipment for advanced numerical simulation:
- Work Stations
- Cluster
- Software: Abaqus, Ansys Workbench, Marc, Kissoft, Adams, ...

Product testing laboratory:
- Test bench for brakes and suspensions
- Multifunction motors (1000Nm y10000rpm) test bench
- Spindles test bench
- Gear testbench

COLLABORATIVE RESEARCH CONTRACTS

Long-term collaboration research contracts with
- AMPO
- Edertek
- Mondragón Automoción
- Shuton
- UPTC

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1. Identification of noise and vibration sources in order to optimise industrial components.
2. Characterisation of materials’ mechanical and acoustic properties with frequency dependence, such as, composites, sandwich, magnetorheological polymers, etc.
3. Monitoring and diagnosis of failures of electromechanical systems by using indicators
All by simulation methods, validated with experimental characterizations
Research Areas

Identification of noise sources in industrial components and its optimisation

Experimental measurements with the objective of identifying the different sources of noise. Subsequently, through updating and optimisation techniques, the final design of the product is defined. Examples:
- Electric machines
- Brake-clutch: squeal problems

Characterisation of materials

Characterisation of the mechanical properties and acoustic properties of different materials, such as:
- Composites
- Sandwich
- Elastomers
- Magnetorheological elastomers
- Magnetorheological sandwich.

The group has developed a characterisation methodology which has been validated by scientific articles

Monitoring and diagnosis of failures in electromechanical systems

Modeling of the system and identification of different indicators that allow to know the diagnosis of components.
FACILITIES

For experimental measurements:
Bruel & Kjaer Pulse system (measurement, analysis, modal, sound quality,…), DACTRON vibration servocontroller, shakers, impact hammers, several sensors (accelerometers, microphones, sound intensity probe, noise and vibration calibrators), Polytec laser interferometer, Kundt’s tube to measure sound absorption and transmission, binaural head, system to measure damping, etc.

For simulations:
LMS Virtual.Lab, Abaqus, MSC Nastran, Pulse Reflex, etc.
The research activities developed in the group of Fluid Mechanics combine models and methods, both analytical and numerical and experimental. The results of these activities have led to new collaborations with internationally renowned institutions such as the European Space Agency (ESA), among others. It also has a large number of external partners, both nationally and internationally, as reflected in the different joint projects developed and the work published in collaboration. The main objective of the Fluid Mechanics group is to acquire and generate new knowledge to continuously advance in their research areas by encouraging, at national and international level, cooperation in higher education and technology transfer to innovation and the quality R&D&i.
Research Areas

Thermofluidic-Aerodynamics

This team develops various research projects and technology transfer activities by numerical simulation of fluid dynamics (CFD) and experimental validation. The group that began researching in the field of aerodynamics in the sectors of energy, automotive, construction and sport, has now extended its work to other areas of scientific and technical interest. These projects include studies of multiphase flows, coupled thermofluidic problems and fluid-structure interaction.

Complex fluids

With a proven international experience in the field of transport phenomena in liquid mixtures and simulation of the behaviour of the thermo-hydro-dynamic fluid, thermo-hydro-dynamic stability, etc. It should be noted that recently, the team is working on projects especially related to Health and Energy sector, covering studies related to microfluidics, nano-fluidics, liquefied fluids under high pressure, fluids of biotechnological interest and multicomponent liquid mixtures.

Magnetorheological materials

This team has identified this area as a strategic line of research in the field of technology transfer, especially for the industrial sector. The research team has focused on the synthesis, characterization and modelling of both magnetorheological fluid and elastomers, with the aim of developing a new generation of intelligent systems to be applied in the industrial environment. According to this objective, to date, it has worked primarily in four sectors: Vertical Transportation, Machine Tool, Automotive and Whitegoods.
2015-2016

- 5 PhD Students
- 3 European Projects
- 5 doctores
- 10 contratos de transferencia
- 1 Ikerbasque
- 600 000 € budget
- 12 JCR publications
- 2 books chapters
- 2 patents

EQUIPMENT
- Software: ANSYS (Campus edition), XFLOW
- 8 work stations, 2 computer clusters (292 cores in total)
- Density meter, rheometer and viscometer (for high and low pressure)
- Thermo-gravitational and molecular diffusion installation
- Refractometer, thermal imaging camera

LABS
- CFD
- Wind tunnel
- Microfluidics
- Complex fluids

PROJECTS
- SUSFOOD-SUNNIVA
- DCMIX
- ACTIMAT
- HAIZELAB

COLLABORATION NETWORK

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Research projects and knowledge transfer of this research group focus on the study of component surfaces to optimise its functionality. Through advanced characterization methods, the root cause of failures created by friction, corrosion and mechanical degradation of surfaces can be diagnosed as well as the impact of the micro-geometry on the proper functioning of the system. This makes it possible to propose surface designs tailored to each application.
In applications where the surface is key to the functionality of the product, the micro-geometry of the surface dominates their behaviour. The group has extensive experience both in measuring surfaces and in the development of measurement protocols tailored to specific products. Micro-geometric level analysis of profiles and surfaces are carried out; both, measures associated with the undulation, roughness and micro-roughness, and measures of volumes of islands, cavities, etc.

The determination of the tribological behaviour of surfaces is carried out from the analysis of the friction generated in the friction systems and the study of the wear mechanisms. In addition, the group studies in depth the type of contact generated in order to propose alternative solutions from the design phase of the product. To do so, we work at theoretical and experimental level and also using numerical simulation techniques by finite elements.

Corrosion in different atmospheres is analysed with potentiometric techniques. Thanks to the long experience of the group on tribology and corrosion, the team has specialized in the analysis of the phenomena of tribocorrosion. The synergies generated in the coupling of both phenomena lead to identify undetectable problems by the independent study of each degradation mechanism.

Various analysis can be conducted using standardized tests or tests that simulate real use conditions. It is interesting to build devices designed ad hoc for this purpose. The group has experience in the design and development of this type of test benches for the study of degradation in service components (cables, wheels, guides, slides, etc.). Standard testing protocols are also adapted to the needs of each application and new test methods are developed.

**Surface engineering is a valuable tool in achieving the functionality of a material to reach to the required performance**
FACILITIES

Tribology lab
Two tribometers (Prizma and Microtest) for characterizing friction, lubrication and wear that also allow working with different contact and load configurations. Gravimetric analysis possibility in Metler Toledo precision microbalance. Three sensorised test benches for degradation analysis of different types of wires and a test bench for wheel and skates wear.

Surface micrometric measurement lab
Confocal profilers Sensofar Plµ y SNEOX.

Corrosion lab
Salt spray chamber for standard corrosion tests in artificial atmospheres. Climate chamber with possibility of ultraviolet light. VoltaLab Potentiostat for analysis of behavior to corrosion of materials and a digital pH meter to control pH in tests media.

Other
Scanning Electron Microscopy FEI Nova NANOSEM 450 y Optical Microscopy LEYCA.

PROJECTS

- NESS: New suspension element
- BIOPREDICT: 3D Topographic characterization of dental implants and surface integrity prediction after insertion.
- RUCODEG: Analysis of the influence of the roughness of the throat of the pulley and cable configuration in the degradation of coated wire / cable pulley systems.
- MARCO AMPO: Degradation of valves under severe conditions.
Research and transfer activity oriented to the consistent integration of information and material flows through the entire system, from the supplier to final client, including those other flows involved.
## Research Areas

### Project Management

- Project Management (PM) through the main approaches: PMBOK®, Critical Chain and Agile Project Management.

**Main areas:**
- Comprehensive PM
- Risk management
- Multi-project management
- Environments,
- Project Portfolio Management

### Management of Industrial Assets

- Status and conservation of the equipment and industrial installations, from the perspective of a strategic activity to support a competitive production system.

**Main areas:**
- Design and implementation of operational techniques (corrective, preventive, improvement,...)
- Organizational aspects in the Maintenance Management.
- Advanced Techniques: TPM, RCM ...

### Manufacturing Engineering

- Study and improvement of industrial process design by means of production plants’ lay-out oriented to lean production through the use of related techniques

**Main areas:**
- Lay-out design and improvement.
- Design of manufacturing cells.
- Implementation of JIT techniques: 5S, SMED, Kanban, OEE...

### Robustness Process Engineering

- Robustness of manufacturing processes and supply products and/or services, also taking into account Environmental Impact Assessment (EIA), prevention and occupational hazards.

**Main areas:**
- Application of DOE in industrial processes and operations.
- CE marking in medical devices.
- ISOs reference management systems.
- Implementation of process management.
- Implementation of the 6-sigma methodology.
- Analysis of the environmental impact.

### Supply Chain Management

- Identify, display and analyse the key aspects of the Supply Chain to better manage them and improve the flow.

**Main areas:**
- Lean Logistics
- Design of Distribution nets
- Implementation of DDMRP to purchasing, production and distribution contexts
- Implementation of TOC-DBR approach to production contexts
- Process simulation.
- Demand Driven MRP (DDMRP).
- Theory of Constraints (TOC).
Management of Industrial Assets
• Diagnosis and comprehensive (integral) improvement of maintenance.
• Design and improvement of Maintenance Management activities (actions)
• Design and implementation of operational techniques (corrective, preventive, improvement,...)
• Design and improvement of management of replacement part
• Implementation of the methodology to assess the risk in machines
• Implementation of CE marking in machines

Project Management
Integral improvement of Project Management
Implementation of the Critical Chain Project Management method
Re-design of the organizational structure of the company
• Diagnosis and improvement of the management of projects
• Implementation of Agile Project Management methodologies

Manufacturing Engineering
• Diagnosis and improvement of productive processes.
• Comprehensive improvement of the Value added Chain of industrial processes.
• Put in place of techniques related to Lean Production.
• Redesign of Organizational structure for Lean production.

Robustness Process Engineering
• CE marking in medical devices.
• Implementation of management systems for the prevention of occupational risks, quality and the environment.
• Implementation of process management methodology.
• Implementation of Statistical Process Control (SPC).
• DOE – Design of experiments.
• 6-Sigma implementation.
• Methodology for assessing environmental pollution in industrial areas.

Supply Chain Management
• Simulation of logistics systems: production processes, warehouses, distribution networks, ...
• Implementation of DBR methodology of the Theory of Constraints (TOC) for the optimization of production in different plants.
• Implementation of Demand Driven MRP methodology: material management through the supply chain with the aim of optimizing the service level.

PROJECTS

2017
2018

2 doctors

5 PMP©
(Certified Project Management Professional)

4 CDDP
(Certified Demand Driven Planner)

1 DDLP
Demand Driven Leader Professional

4 PhD students

+ - 15 transference projects

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Research and transfer projects within this research group focus on the strategic management of organizations, innovation management, technology and corporate and territorial entrepreneurship, as well as the modelling of complex decision making processes; with the final aim of contributing to the improvement of competitiveness and sustainability of organizations and territory.
Research Areas

INNOVATION AND TECHNOLOGY MANAGEMENT
- Business Innovation
- Managing Innovation
- Innovation Frameworks, models and systems
- Innovation Processes and Projects
- Management of Technology
- Innovation Management Techniques and Tools
- Agile Innovation
- Open Innovation
- Business Models
- Servitization
- Industrial Product Service Systems
- Manufacturing Strategy
- Collaborative Innovation
- Innovation networks
- Management Maturity Models
- Supplier development

CORPORATE ENTREPRENEURSHIP
- Entrepreneurial University
- Corporate entrepreneurship
- Entrepreneurial Management Techniques and Tools
- Lean Start up
- Agile Entrepreneurship

COMPLEX MANAGEMENT SYSTEMS MODELING
- System Dynamics
- Group Model Building
- Agent Based Modelling
- Socio-Technical Simulation
- Innovation Networks
- Serious Games
- Training Simulation
- Discrete Event Simulation

INDUSTRIAL ORGANIZATION
- Organizational behaviour
- Production organization
- Evidence Based Management
- Advance Statistical Analysis
- Structural Equation Modelling
- Longitudinal Analysis

"Unfortunately, I'm an engineer. I'm always thinking about, what's the task and how do I get it done? And some of my tasks are pretty broad, and pretty fuzzy, and pretty funky, but that's the way I think."
RESEARCH PROJECTS

TRANSFERINN (Interreg – POCTEFA)
Generating an innovation ecosystem for micro, small and medium enterprises and entrepreneurs based on knowledge transfer.

T-DoRe (EIT RawMaterialas)
Create new innovation champions through training of T-shaped professionals for RTOs and industry in the raw materials sector.

UEB2 (IBA, Basque Government)
Accelerating the road towards the Entrepreneurial University.

BATERATZEN (Gipuzkoa, empresas comprometidas)
The alignment of people behaviours with strategic challenges of organizations.

KIT-VPD and BARNELKAR (Gipuzkoa, territorio que aprende)
Both projects focus on implementing a methodology to deploy agile innovation in micro SMEs based on the Value Proposition and Industry 4.0 approaches.

IC FP Euskadi (Department of Education, Basque Government)
Design and deployment of a competitive intelligence system among the vocational training institutions of the Basque Country.

INDUSTRIAL PROJECTS

- Design and implementation of Innovation Management Systems
- Implementation of Agile Innovation Processes
- Management of Technology
- Implementation of creativity processes and creativity workshops
- Management Process improvement and innovation
- Agile entrepreneurship process implementation
- Management Systems Modelling and Simulation
- Implementation of Open Innovation Processes and Projects
- Analysis and benchmark of people alignment with organizations’ strategies

* Database with more than 465 companies and 65,000 surveys (longitudinal)
User-centred design is a methodology that aims to create systems of product / service that can get the highest satisfaction and best user experience for the consumer or customer. It is a methodological process of identifying necessities, objectives, expectations, motivations and abilities of people, and it is these elements that guide each stage of the design process.
"Experience Design" With regard to design experiences, main aspects focus on the design moments and experiences that create emotional links with the service or product.

"Service design" is the application of the principles, methods, processes and design tools to design services.

"Interaction Design" covers aspects such as usability concepts, perception and intuitiveness. Having the equipment "Eye Tracking" and "Face Reading" for their analysis.

"Design for All" aims to prioritize the inclusion of the widest possible range of users in the design. This implies the need to identify and understand human capabilities and diversity.

"Eco Design" focuses on designing and developing eco-efficient products and services, thus helping to reduce the environmental impact and generate changes in the habits of people.

Eric Ries

“Design is more than just how that something looks, more than how something functions. Design has evolved to even consider how you feel when you use, or are about to use something."
FACILITIES

Interaction Lab: Eye tracking and Face reader.
Image Lab: 3D scanner, 3D printing, scenarios.
Prototype workshop: to create all kind of prototypes.
Co-creation and creativity room: This space is used for co-creation and creativity sessions with companies and students.

PROJECTS

1. SIM ACP (Gaitek, Basque Government)
The overall objective of this project is the design and development of a Serious Game for its implementation to a Person Centered Care Model in gerontology centers.

2. INBEDI I y INBEDI II (Gipuzkoa territorio que aprende)
The project focuses on designing a methodology to integrate User Driven Innovation in companies. It has also developed a toolkit and designed learning workshops to empower this methodology in industrial environments.

3. YESict (Erasmus + Strategic Alliance)
YESict (Young Entrepreneurial Skills by ICT) aims to promote entrepreneurial skills in children between ages 10-15 through person-centering design methodologies and tools.

4. HMI Human machine interacción in machine tools (Danobat Group, Fagor arrasate)
Design and development of numerical control machines for improved usability and inductance of operators.

5. MOTIVA-PRO (Gipuzkoa territorio que aprende)
Development of a structured guide that allows companies to learn to detect and materialise the opportunities for innovation from the perspective of motivation or rationale.

6. ERMUATIC (Ermua city council)
Application of ICT for senior user/patients to the health service of Ermua.
The research and transfer projects of the electrical energy research group are oriented to the analysis, modelling, design, implementation, control and diagnosis of Power Electronic Converters, Electrical Machines and Energy Storage Systems for the following applications: Electric power systems, electric traction systems, renewable energy, home appliances and industrial processes and drives.
The research area is focused on:
• Applications in new power electronic components (SiC, GaN)
• High-Power Medium-Voltage power electronic devices.
• New power electronic converter topologies development.
• Modulation and control strategies.
• Design and development of Medium Voltage grid connected power electronic devices.
• Coordination of electric-electronic components for distributed generation applications.

The research area is oriented to:
• Advanced Controls: High dynamic controls, low-cost sensorless controls, dynamic algorithms to optimize the efficiency & noise.
• Optimized Designs for each Application: Selection the best topology
• Reliability: Intelligent drives with integrated diagnostic, Advanced thermal estimators, Life acceleration tests.

The research area is focused in electrochemical energy storage technologies (LiOn, LeadAcid, NiMH, EDLC, LIC...):
• Cells characterization and modelling included the electrochemical and thermal behavior and post-mortem.
• Design, implementation and test of battery packs, included BMS.
• Research in algorithms for State of Charge, Health and Functionality.
• Hybrid energy storage systems.

• E-Mobility: Railway, Electric and Hybrid Vehicles and Elevators
• Grid: Renewable Generation Integration, Power Quality, Grid Code Compliance, FACTS devices, AC and DC microgrids, grid connected storage systems
• Wind Power: Wind farm control and management, DFM control
• Industrial: PMSM and Induction machines, Medium-Voltage High-Power drives, energy efficiency
**FACILITIES**

**Medium-Voltage laboratory**
4 MVA power available in the laboratory, with a variable voltage range from 3x230VAC to 3x30KVAC. In this laboratory STATCOM devices, 30kVac static switches and 3MVA wind generation systems have been tested in this laboratory.

**Energy Storage Laboratory**
This laboratory is intended for the cycling and characterization of energy storage cells and systems. Configurable voltage range from 1Vdc up to 300 Vdc and maximum power of 20kW.

**Electric Machines Laboratory**
A test bench of 150 kW and several test beds of 20 kW are available for the characterization and testing of electrical machines and control strategies using Dspace fast prototyping platform.
Magnetic materials characterization for testing magnets and magnetic sheets.

**HIL (Hardware in the loop) platform**
1 OpalRT HIL platform and 2 NI platforms are available, for emulating the behavior of electric/electronic systems on real time using optimized models.

**VENUS**
The 95% of the global supply of the materials for magnets is provided by China. Find an efficient and power dense alternative to permanent-magnet machines is the purpose of VENUS

**PROJECTS**

**OPTEMUS**
Optimized energy management and use represents an opportunity for overcoming one of the biggest barriers towards large scale adoption of electric and plug-in hybrid cars.
[http://www.optemus.eu/](http://www.optemus.eu/)

**EU-LIVE**
The objective of is to overcome the existing barriers of L-category vehicle industry on the basis of intense collaboration and transfer of know-how concerning methods, components and technologies from the high-volume automotive industry.
[http://eu-live.eu/](http://eu-live.eu/)

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