2nd Public Technical Workshop on Condition Monitoring of Complex Systems.

Hosted by The H2020 European Training Network "MOIRA"
(Monitoring of Large Scale Complex Technological Systems)

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MEMBER OF BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

IEEE Robotics & Automation Society
Spanish Chapter

5O ikerlan

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1. Welcome.
2. Agenda.
3. IKERLAN S. COOP.

2nd Public Technical Workshop on Condition Monitoring of Complex Systems

WELCOME.

The workshop highlights the developments of the MOIRA project, which objective is to develop the next generation of knowledge discovery methodologies, algorithms and technologies, so enabling data-driven, plant-wide fleet monitoring, with the focus on real-time diagnostics and prognostics. This objective is achieved by having 15 early-stage researchers (ESR) working closely and interacting frequently in this interdisciplinary and multi-disciplinary area.

During these **3 days of workshop**, the main results obtained in the research carried out by each of the ESRs will be presented and discussed. In addition, during a special session sponsored by the IEEE Robotics & Automation Society (Spanish Chapter), different works in the field of the fusion of robotics and monitoring technologies will be presented and discussed. The workshop is completed by **2 seminars** entitled 'Model-based & hybrid condition monitoring of mechatronic systems' and 'Process automation & Monitoring Systems'.

2nd Public Technical Workshop on Condition Monitoring of Complex Systems

AGENDA.

	13:45	14:00	*Arrival*
	14:00	14:30	2nd Public Workshop Welcome & Company presentation IKERLAN S. COOP.
Wednesday 5th **IEEE Robotics & Automation Society**	14:30	15:30	**Precision Control in Industrial Mobile Manipulators: Challenges and Solutions** Naroa Nuñez (IKERLAN) **Model-Based Trajectory planning Implementation and Intelligent Refinement** Daniel Bilbao (IKERLAN)
	15:30	16:00	*break*
	16:00	17:00	**Robotics in Autonomous Drone Inspections: A Case Study in Wind Energy** Javier Aldazabal (ALERION)
	17:00	18:00	**Tour:** IKERLAN facilities (DIGILAB)
	18:00		*Close*
	20:00		*Official Dinner at Portalon (Vitoria-Gasteiz)*

2nd Public Technical Workshop on Condition Monitoring of Complex Systems

AGENDA.

			2nd Public Technical Workshop on Condition Monitoring of Complex Systems
	8:45	9:00	*Arrival*
	9:00	10:30	Scientific Skills Training (S10 - Part 1) **Process automation & Monitoring Systems** Jacopo Cavalaglio Camargo Molano (Tetra Pak), Marco Cocconcelli (University of Modena and Reggio Emilia)
	10:30	11:00	*break*
	11:00	12:30	Scientific Skills Training (S10 - Part 2) **Process automation & Monitoring Systems** Jacopo Cavalaglio Camargo Molano (Tetra Pak), Marco Cocconcelli (University of Modena and Reggio Emilia)
	12:30	13:30	*Lunch*
Thursday 6th	13:30	15:30	**Automatic multi-sensor validation methods** Lan Jia (SIEMENS Industry Software NV) **Onboard aircraft engine monitoring analyzing vibratory and sound signals captured by smartphones / tablets** Fadi Karkafi (SAFRAN SA) **Heterogeneous data fusion for monitoring of mines using robotic devices** Mohammad Siami (AMC VIBRO) **Transfer learning for predictive engineering analytics in fleets** Deepti Kunte (SIEMENS Industry Software NV)
	15:30	16:00	*break*
	16:00	18:00	**Remaining fatigue-life prediction of heavily loaded uncertain industrial systems** Benjamin Tapia (IKERLAN) **Enhancing infrastructure monitoring using a FMEA-based systematic and holistic system analysis** Atabak Mostafavi (Fraunhofer-Gesellschaft Zur Foerderung Der Angewandten Forschung E.V) **Modelling & analysis of long term heterogeneous historical data of time varying complex systems in presence of impulsive noise for condition monitoring** Hamid Shiri (Wroclaw University of Science and Technology) **A Hybrid Prognostic Methodology for Aircraft Systems** Felix Fu (Cranfield University)
	18:00		*Close*

2nd Public Technical Workshop on Condition Monitoring of Complex Systems

AGENDA.

			2nd Public Technical Workshop on Condition Monitoring of Complex Systems
	8:45	9:00	*Arrival*
	9:00	10:30	Scientific Skills Training (S9 - Part 1) **Industrial applications of condition monitoring and asset management** Urko Leturiondo (IKERLAN), Ana Gómez (IKERLAN), Angel Rodríguez (IKERLAN)
	10:30	11:00	*break*
	11:00	12:30	Scientific Skills Training (S9 - Part 2) **Model-based & hybrid condition monitoring of mechatronic systems** Konstantinos Gryllias (Katholieke Universiteit Leuven)
	12:30	13:30	*Lunch*
Friday 7th	13:30	15:00	**Human Cognition in Future Maintenance Operations in Autonomous Machines** Parul Khanna (Luleå University of Technology) **Hybrid techniques for condition monitoring of motion control applications** Jabbar Abdul (University of Modena and Reggio Emilia) **Probabilistic Learning for Patient Health Monitoring** Jenny Yang (University of Oxford)
	15:00	15:30	*break*
	15:30	17:30	**Improving virtual sensing by multi-complexity models** Mojtaba Ahani (Institut National des Sciences Appliquées de Lyon) **Probabilistic fleet monitoring based on model manifold** Achilleas Achilleos (Institut National des Sciences Appliquées de Lyon) **Self-learning intelligent monitoring of cyber-physical system fleet** Fabrizio De Fabritiis (Katholieke Universiteit Leuven) **Wear monitoring of mechatronic systems under variable operating conditions by integration of heterogeneous data** Douw Marx (Katholieke Universiteit Leuven)
	17:30	18:00	Closing remarks
	18:00		*Close*

2nd Public Technical Workshop on Condition Monitoring of Complex Systems

WELCOME.

Useful information

- **WiFi: IKERLAN_BISITARI**
- **Bus service**
  - 05/06/2024
    - 12:45 C/ La paz 7, Vitoria-Gasteiz
    - 18:00 IKERLAN
  - 06/06/2024
    - 08:00 C/ La paz 7, Vitoria-Gasteiz
    - 18:00 IKERLAN
  - 07/06/2024
    - 08:00 C/ La paz 7, Vitoria-Gasteiz
    - 18:00 IKERLAN
- **Official dinner:**
  - Restaurant: El Portalón
    - C/ Correría 151, CP 01001 Vitoria-Gasteiz
  - Date: Today at 20:00

Where technology is an attitude.

Jesus M. Ruano
Head of International department

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1. About us.
2. Our difference in 4 key points.
3. Our expertise.
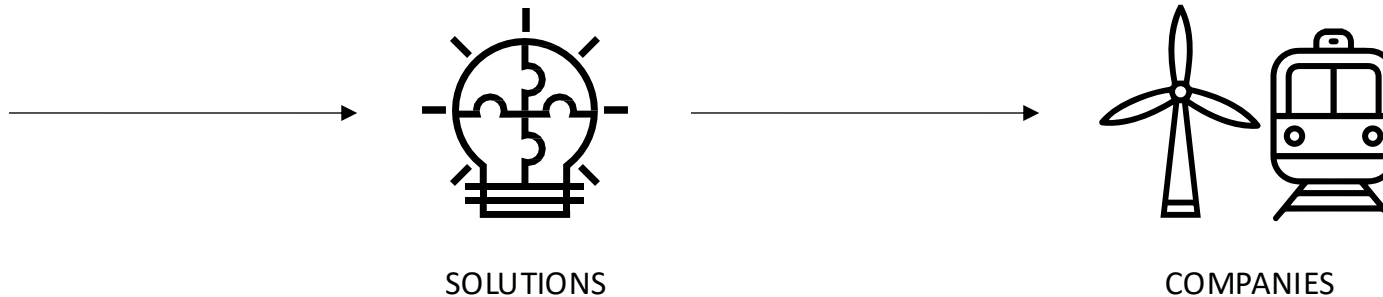4. Real technology for real challenges.

1.

About us.

ikerlan

We are a
technology center.

Committed to developing the technology that companies need to permanently transform their processes, products and services.
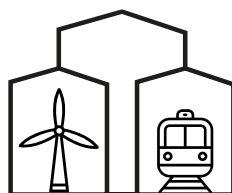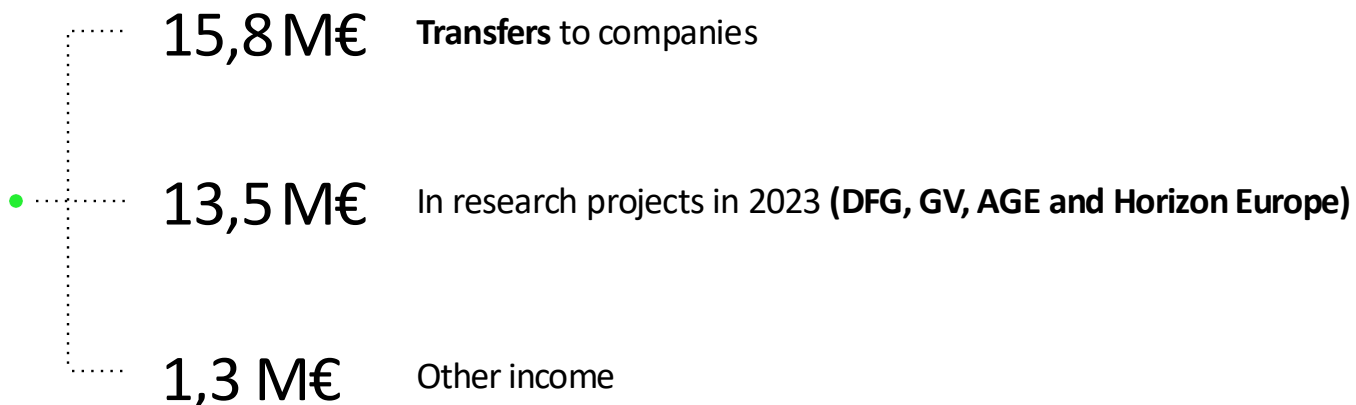
IKERLAN.
WHERE
TECHNOLOGY
IS AN ATTITUDE

SOLUTIONS

COMPANIES

In figures.
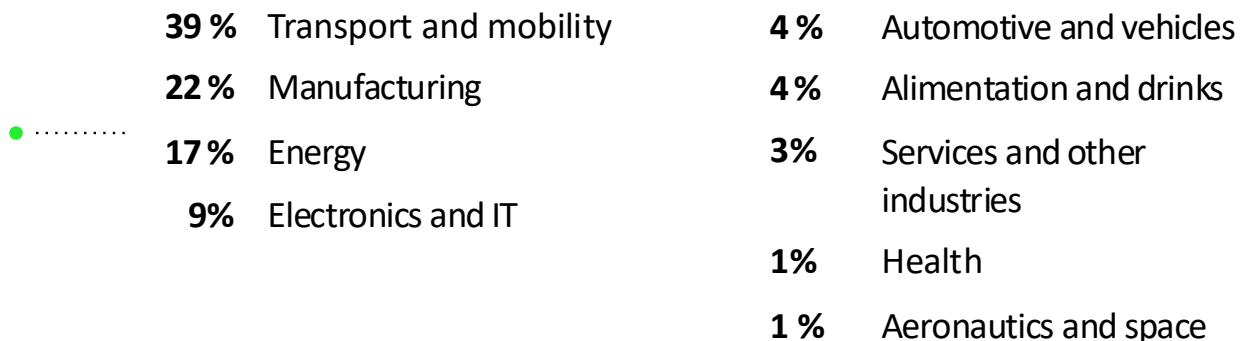
(2023)

OVER

407

PEOPLE

• ········· Ready for present and future technological challenges

30,6 M€

TOTAL INCOME FOR 2023

15,8 M€ **Transfers** to companies

13,5 M€ In research projects in 2023 **(DFG, GV, AGE and Horizon Europe)**

1,3 M€ Other income

Sectors

39 %	Transport and mobility		**4 %**	Automotive and vehicles
22 %	Manufacturing		**4 %**	Alimentation and drinks
17 %	Energy		**3 %**	Services and other industries
9 %	Electronics and IT		**1 %**	Health
			1 %	Aeronautics and space

50 years and this has only begun.

In 1974, IKERLAN began its journey with the aim of developing technology that would improve the innovation and competitiveness of the companies in its environment. It did so as one of the fundamental pillars of the Mondragón experience, the cooperative model promoted by the renowned Basque priest, José María Arizmendiarrieta.

Today, 50 years later, IKERLAN is a pioneer in applying artificial intelligence in industry, it has developed the first tram that works without catenary, and we have reached space by collaborating with NASA.

What will we be doing in another 50 years? We do not know. But we do know that the experience of having come this far and the attitude of continuing to progress are the best bets for the future.

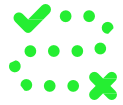# 2.

Our difference in 4 key points.

3. Our expertise.

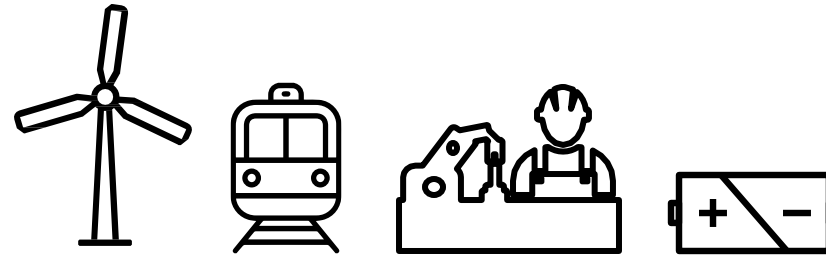4. Real technology for real challenges.

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1

USEFUL TECHNOLOGY.
We transfer
technology to industry

REAL TECHNOLOGY FOR
REAL CHALLENGES

we cooperate with the companies in the
development of everyday products.

TECHNOLOGY AND PEOPLE:
THE KEY TO OUR SUCCESS

TECHNOLOGY

University   IKERLAN   Companies

PEOPLE

Higher   Technological   Industry
education   specialization

2

TOGETHER IS BETTER.
Cooperative organizational model: commitment and efficiency

We work **together**.

**WE COOPERATE
WITH OUR CLIENTS**

- We collaborate in the **strategic definition.**
- Joint **work teams**.
- Talent recruitment and development.
- We offer **multi-technological solutions.**

We are a cooperative created in 1974 by the companies of the current Mondragon Corporation.

Member **of Basque Research & Technology Alliance** and **RVCTI.**

Member of **Fedit, Spanish Federation of Technology Centres.**

Strategic collaboration in **research** and **people**.

Mondragon Goi Eskola Politeknikoa .

Mondragon Unibertsitatea, Faculty of **Engineering**

A cooperative and unique university immersed in entrepreneurial reality and specialized in technological training:

10 Engineering Bachelors

9 Engineering Master Degrees

7 Higher Level Training Cycles

216 Lifelong Learning Programs

18 Research and Transfer specialities

Mondragon
Unibertsitatea
Goi Eskola
Politeknikoa

The Polytechnic School of Mondragon stands out for:

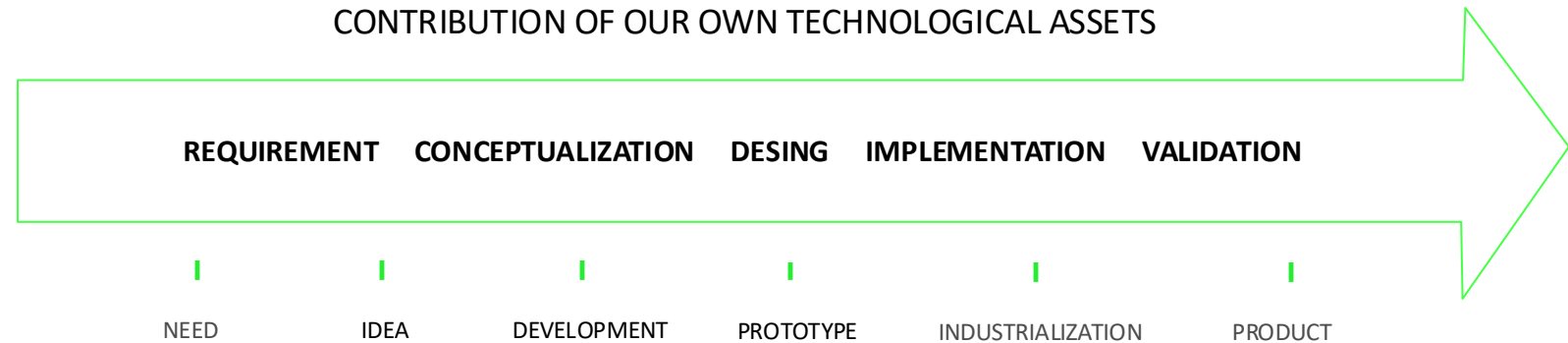| Practical and reliable training aligned to business needs	Building strong collaborative relationships with companies and institutions around innovation	State-of-the-art scientific-technological equipment	Promotion of technological entrepreneurship	Firm commitment to promote the territory development
DUAL training referents since **1943** Unemployment rate of graduates **5 %**	**19,5 M€/year** Leaders in external research funding **50.4 %** Of teaching staff is dedicated to research and transfer	**>2M €** annual investment in technological equipment **>15.000m^2** Laboratories available to students and companies	**21** companies created by Alumnies	Rated as **Excelent** in international rankings For each public € received, **7,6 €** is returned to society.

3

WE ARE TECHNOLOGISTS.
From idea to product

We develop industrial prototypes through the application for our technological knowledge.

OUR PARTICIPATION
IN PROJECTS

CONTRIBUTION OF OUR OWN TECHNOLOGICAL ASSETS

REQUIREMENT   **CONCEPTUALIZATION**   **DESING**   **IMPLEMENTATION**   **VALIDATION**

NEED   IDEA   DEVELOPMENT   PROTOTYPE   INDUSTRIALIZATION   PRODUCT

4ᵗʰ

IN GOOD SHAPE.
Agile technology centre, looking towards the future

13,5 M€ > **In research projects** in 2023
(DFG, GV, AGE and Horizon Europe)

OVER
2,4 M€ > In technological investments to provide the best equipment and infrastructures

OVER
1,9 M€ > Student training: future researchers

62 Doctoral thesis in progress

110 Staff in training

3.
Our
expertise.

3 technological units with 3 lines of research.

DIGITAL TECHNOLOGIES & ARTIFICIAL INTELLIGENCE

Distributed and Connected Intelligence
· Smart Connectivity.
· Intelligence of Things.
· Dependable Intelligent Software.

Artificial Intelligence & Data
· Cloud Data Spaces.
· DataOps.
· Artificial Intelligence.

ENERGY AND MECHATRONICS

Mechatronic Technologies
· Machine Dynamics and Manufacturing Processes.
· Control and Robotics.
· Mechanical Reliability.
· Thermofluidic and Thermomechanic Design.

Energy Storage and Power Electronics
· Power Electronic Converters.
· Electromagnetism and Converters Control.
· Energy Storage and Management.
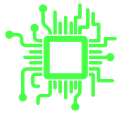
ELECTRONIC EMBEDDED SYSTEMS AND CYBERSECURITY

Electronic Embedded Systems
· Hardware and Electromagnetic Compatibility.
· High-Performance Embedded Platforms.
· Embedded Systems and Embedded Software.

Cybersecurity and Dependability
· Dependability and Cybersecurity Methods.
· Cybersecure Embedded Systems.
· Cybersecure Digital Systems.

3 research focuses aligned with our **3 areas of expertise**.
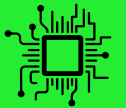
DIGILAB

- · Dependable embedded systems laboratory.
- · EMC.
- · PCB.
- · Cybersecurity laboratory.
- · Hardware platforms laboratory.
- · Robust communications laboratory.
- · 5G laboratory.
- · Edge Computing laboratory.

- · Artificial intelligence laboratory.
- · Computing servers and cloud access laboratory.
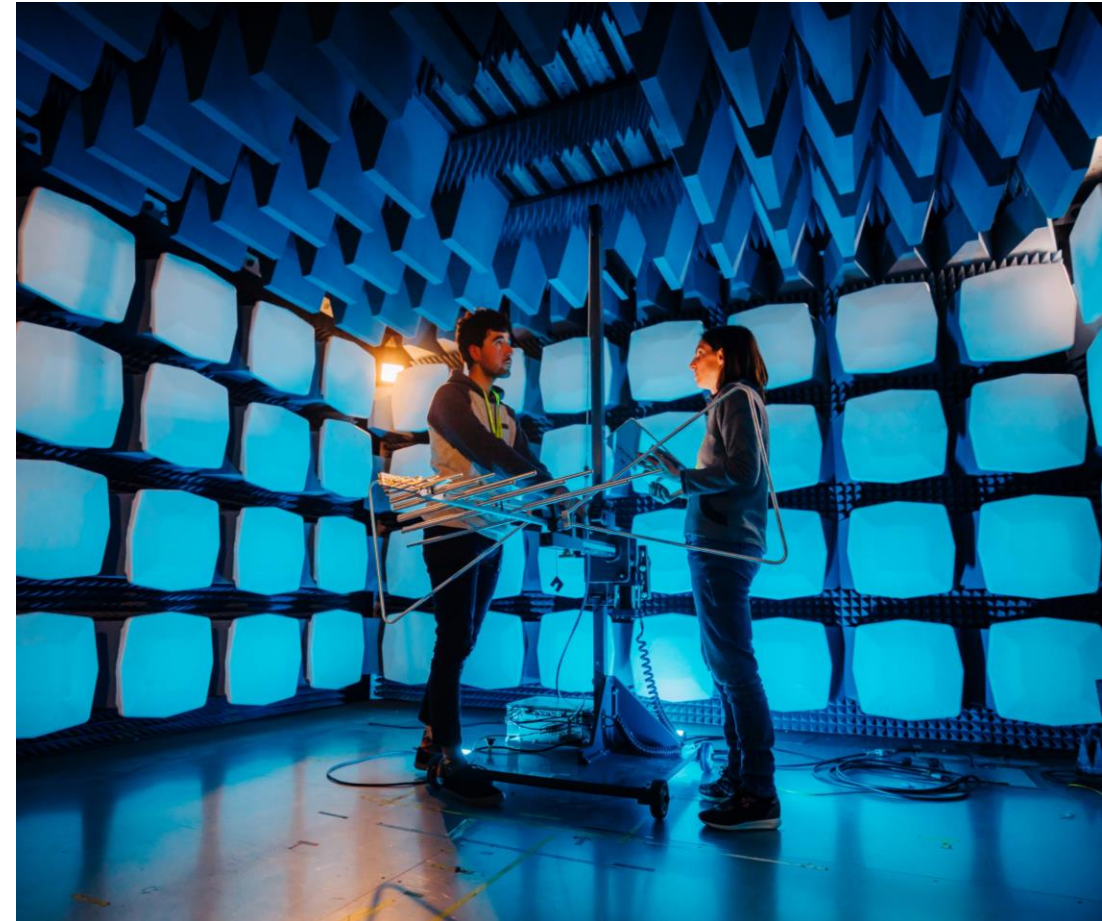
ENERGYLAB

Laboratory:
- · Medium voltage and power electronics.
- · Energy management .
- · Electrical energy storage systems.

MECHLAB

Laboratory:
- · Robotics and automation.
- · Structural reliability.
- · Acoustic testing.
- · Combustion.

"We collaborate with leading technological centers and universities in a global scope".

1. BASQUE COUNTRY

2. SANTANDER **3. OVIEDO** **4. GIRONA** **5. BARCELONA**

6. VALENCIA **7. SEVILLE** **8. SANTIAGO DE COMPOSTELA** **9. PARIS** **10. BESANÇON** **11. GRENOBLE** **12. LEUVEN** **13. BRUSELAS**

14. EDINBURGH **15. AACHEN** **16. SIEGEN** **17. ZÚRICH** **18. VIENNA** **19. LULEÅ** **20. AALBORG** **21. OLDENBURG** **22. USA**
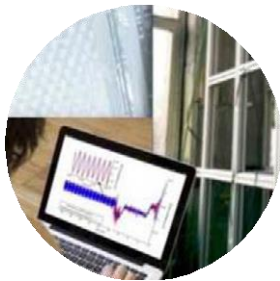
4.

Real technology for real challenges.

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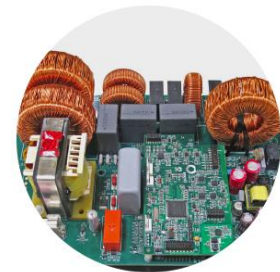# "Over 25 years collaborating in a stable way with 80% of our clients".

MECHATRONICS AND AUTOMATION

Robust design of elevators. Diagnosis for predictive maintenance.

EMBEDDED SYSTEMS

Control, connectivity, security and IoT: M2M cybersecure systems.

ENERGY AND POWER ELECTRONICS

Elevator with energy regeneration capacity.

EMBEDDED SYSTEMS

ERTMS railway signaling and control systems. DIGITAL TRAIN strategic project.

ENERGY AND POWER ELECTRONICS

Power electronics systems based on silicon carbide.

ENERGY STORAGE

Ultra-capacity lithium storage systems for the railway sector.
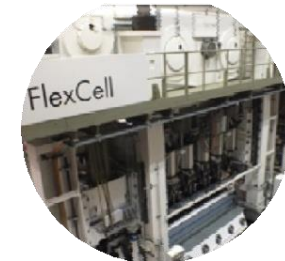
INFORMATION AND COMMUNICATION TECHNOLOGIES

Development of FA LINK digital platform.

Watch video

MECHATRONICS AND AUTOMATION

Efficiency in the commissioning of equipment goods.

MECHATRONICS AND AUTOMATION

Design and control of RTM hydraulic press.

MECHATRONICS AND AUTOMATION

Reliability analisis of crane critical components. Customizable after-sales support.

CYBERSECURE IOT & BIG DATA

Monitoring and remote management of crane operation data. Cloud architecture with Big Data platform.

ENERGY AND POWER ELECTRONICS

Integral electrification of automotive garanty cranes.

Thank you
very much!

For more information follow us on:

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