

PRODUCTION **ENGINEERING LABORATORY**

A multidisciplinary laboratory in the field of science and systems engineering

PRODUCTION ENGINEERING LABORATORY

Tarbes

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GÉNIE DE PRODUCTION





NATIONAL ENGINEERING SCHOOL OF TARBES Design the future



The figures PRODUCTION ENGINEERING LABORATORY

WORKFORCE (October 1, 2018)

Permanent members

- 55 Academic Staff :
- 17 Full Professors
- 38 Associate Professors
- 3 IATOS secretarial staff



Multidisciplinary laboratory

CNU Section	33	60	61	63
Number of teacher-researchers	9	18	24	3

Non-permanent members

- 62 doctorates in progress:
 - 18 CIFRE agreements (industrial partnerships) 23 doctoral contracts
 - 7 equity capital (industrial contracts, regional, European, ANR projects...)
 - 10 co tutoring
 - 4 foreign scholarships
- 4 temporary members for teaching and research (Assistant professor)
- 3 post-doctoral fellows

▶ ENIT is co-accredited in five Doctoral Schools (ED)

Four themes

- ED Material Sciences (SDM)
- Mechanical, Energy, and Civil Engineering and Processes (MEGeP)
- ED Systems Engineering (EDSYS)
- ED Electrical Engineering, Electronics, Telecommunications (GEET)

A cross-disciplinary ED

• ED Aeronautics and Astronautics (AA)

Since its beginnings, the LGP has produced 193 PhDs. 20 assistant professors have taken a research supervision qualification (HDR). Our graduates fit well into both industry and academia in France and abroad.



Two Resource and Competence Centres (CRC)

 CIMMES: Centre of Engineering in Mechanics, Materials and Surfaces

 IDCE: Engineering Decision of and Communication for Companies

Two cooperative technological platforms

 PRIMES: Platform of Research on power Integration and Energy Management of Storage components

• METALLICADOUR: Transfer centre for

high-performance manufacturing technologies: machining, robotization, FSW and other assembly techniques

Two emergent platforms

• CEF3D: Shared research structure in metal additive manufacturing

• CRTCI: Centre of Research and Technology for Composites and Innovative Materials



Total : 9 500 k€ (4 years) excluding permanent salaries





The Production Engineering Laboratory (LGP), created in 1989, was recognized in 1991 and labelled (EA n°1905) in 1995 by the Ministry of Higher Education, Research and Innovation (MESRI).

Located in Tarbes, it is the research laboratory of the National Engineering school of Tarbes (ENIT) and is part of the Federal University of Toulouse Midi Pyrénées and shares many projects with the National Polytechnique Institute (INP) of Toulouse.

The LGP is a multidisciplinary laboratory that develops research activities in the field of Science and Systems Engineering especially in mechanics and material science, the science and techniques of production, automation, robotics and computer science. Research is provided with equipment that is consistent with the needs of companies and the profile of engineers trained at ENIT.

The LGP has established a network of partnerships in different fields of application such as rail systems, aeronautics, health, construction and services.

Interfaces and Functional Materials

Advanced material assembly processes, sustainability of interfaces, ageing and damage, tribology

Decision-making and Cognitive Systems

Knowledge engineering (computing, management of intangible assets): artificial intelligence, post mortem documentation, data sharing, risk assessment, Prognostics and Health Management (PHM), decision support

D

Multiscale Integrated Design

Decision and Interoperability for System Dynamics

Systems engineering: production, planning, supervision, pilot control, virtual reality, vision. HW/SW co-design, robotics. human-machine interaction, power electronics

► For more information:

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The LGP is made up of four research teams: • IMF - Interfaces and Functional Materials • M2SP - Material, Structure and Process Mechanics • DIDS - Decision and Interoperability for System Dynamics • SDC - Decision-making and Cognitive Systems

Each team works with scientific topics within Engineering Sciences (IS) or Information and Communication Sciences and Technologies (ICST), which are applied to problems in Production Engineering, the central focus of LGP. The research is generally oriented towards multi-scale integrated design, and usually connected to real-world social and economic problems. The entire product life-cycle is followed, from design to dismantling.

Material. Structure and Process Mechanics

Experimental mechanics (fatigue, contact-free measuring of fields) modelling and digital simulation, optimisazion of manufacturing processes (machining, ALM metals)

MF GROUP INTERFACES AND FUNCTIONAL MATERIALS

The team activity focuses on understanding phenomena of material and energy transfer between materials and their environment.



performance of structural materials, their surfaces and interfaces, with the following objectives:

interactions between structures, properties and processes

- To establish **prediction laws and kinetics** of damage and ageing
- To understand the mechanisms of **material transfer** and energy at the interfaces
- To ensure the reliability and completion of **functional** surfaces and assemblies

• To understand, manage and optimize the **tribological** response of a system



• Mechanical, tribological and physico-chemical properties of materials (metallic alloys, polymers, ceramics) and multimaterials (composites, coatings, assemblies)

• Development of test benches and associated methodologies, dedicated tests, in tribology,

corrosion, adhesion of coatings

Contribution to the conception of **new materials**

• **Permanent assemblies** by structural bonding, brazing, welding and additive manufacturing

The IMF team is at the cutting edge og experiments in the mechanics and physico-chemistry of static and dynamic interfaces and multi-scale processes for assembling advanced materials. »

Pr. Valérie Nassiet

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The IMF team works to study and improve the MULTI-SCALE PROCESS ENGINEERING AND **ADVANCED MATERIAL ASSEMBLIES**

• To understand and model relationships and Process integration and control (welding, soldering, bonding, composites, additive manufacturing):

- · Reliability of adhesive interfaces, modulation of surface reactivity and adhesive properties
- Formulation of innovative composites with hybrid architecture
- Optimization of assemblies by laser welding on polymers and composites
- Welding of new metal alloys
- Additive manufacturing by deposition of polymer powder layers
- Metallic additive manufacturing SLM, WAAM



MECHANICAL CHARACTERIZATION AND PHYSICO-CHEMICAL INTERFACES STATIC AND **DYNAMIC** UNDER **ENVIRONMENTAL CONSTRAINTS**

Characterization of surfaces and interfaces and study of their damage and durability:

- Mechanical properties and adhesion of thin lavers
- Resistance to localized corrosion
- Durability of adhesive interfaces

· Composites and nanocomposites for applications in severe environments

• Damage analysis of frictional contacts under various environmental stresses (mechanical, thermal, chemical, electrical)

• Optimization of friction/wear of materials

• Dynamic analysis of interfacial elements (friction and wear control)



POLYMER

ADDITIVE



XRay diffraction

Experimental means processes

• Injection moulding machine, compression moulding machine

- Rotomoulding, extruder
- Autoclave, internal mixer
- Laser welding and cutting centre on metal

RESSOURCES & TOOLS

Scanning electron microscopy (SEM, SEM-FEG, EDX

• Optical profilometry (interferometer)

• Atomic force microscopy (AFM)

• Wettability (drop goniometer)

Instrumented macrodurometer

Characterization of functional polymers

• Differential enthalpic microanalyzer (DSC)

• Tensile and compression machines

• Thermal conductivity measurement

• Thermobalance (TGA TMA)

Infrared Spectroscopy (FTIR)

Infrared Microscopy (EBSD)

Surface characterization

• Optical microscopy

Nano-indentation

spectrometry)

and metal alloys

Rheometers

Analysis of assemblies and coatings

- Adhesion tests
- Micro Scratch test
- Micro traction under SEM

• Non-destructive tests: acoustic microscopy, IR thermography, stereo image correlation, X-ray tomography

Ageing chamber (climatic, shock, saline mist)

Tribometry and combined analyses

- High load pion-disc tribometer*
- Environmental Tribometer*
- Fretting device*
- Adhesion device* (static/dynamic transition)
- Bruker UMT-Tribolab Tribometer
- Acoustic emission
- High speed vision
- Thermometry and IR thermography
- Electrical contact resistance

*Equipment designed in-house

MANUFACTURING





PROJECTS AND PARTNERSHIPS

EUROPEANS

• POCTEFA REVALPET: recycling and regeneration of milk bottles made of innovative materials

NATIONALS

- ANR ArchiCaP: architectural materials of substituted calcium phosphate for bioactive bone implants • RAPID SYSCO: study of dry film technology of bonded paints for
- aircraft repair/maintenance applications
- ture for laser fusion of wire for large metal parts
- ANR REVAMITIC: new biomimetic apatite coatings for joint prostheses and osteosynthesis equipment
- ANR Metaltechnics: development of high-performance metallic materials for aeronautical and space applications
- FUI WASPE (IMF/M2SP): lightening of aeronautical structures:
- power and control electronics boxes CORAC GENOME (IMF/M2SP) : polymer durability
- ANR MACCADAM: materials with controlled characteristics produced by arc-metal additive manufacturing

REGIONALS

• AEROSAT SOUDAGE LASER: development of YAG laser welding of aeronautical materials in comparison to laser welding CO₂

• PLASMACUT KEY: calcium phosphate coatings by plasma spraying suspension for dental and bone implants

• READYNOV ROMA: development and optimization of anti-wear coatings obtained by micro-arc oxidation

INDUSTRIAL PARTNERSHIPS

• CIFRE NIMITECH: behaviour of structural parts made of organic matrix composite materials in a hot environment (350°C) and interactions with the support structure

• CIFRE PRISMADD: study of selective laser sintering applied to the manufacture of polyarylether ketone parts

• CIFRE NIMITECH: formulation and implementation of "warm" long-fibre composites with a TP/TD matrix that comply with REACH regulations

• CIFRE SAFRAN Tech-SNECMA: high speed contact in labyrinth zone, identification of mechanical and thermal phenomena and the behaviour of materials

• IRT SAINT-EXUPERY: provision of resources

support for the implementation of activities within the framework of the Metaltechnics project

- CIFRE ESSILOR: study of the adhesion of thin layers
- on polymeric substrate. Application to ophthalmic lenses
- CIFRE SAGEM: study on the reliability of assemblies
- lead-free

M2SP GROUP

MECHANICS OF MATERIALS, STRUCTURES AND PROCESSES

The team is developing work in the field of experimental characterization, modelling and simulation of the behaviour of structures and processes.



The M2SP team works in experimental characterization, modelling and simulation of the behaviour of structures and processes within various scientific and industrial contexts : power electronics packaging, permanent assemblies and welding, optimization of forming and implementation processes, additive manufacturing, composite manufacturing processes, fibers and bio-based reinforcement textiles.

Two major areas of interest:

• **Composite materials** - from fibre to structure: development of woven textile structures, implementing, developing structural composites, and mechanical characterization of samples and structures

• Additive layer manufacturing: adapted design (Design for Additive Manufacturing), machine runability and finishing processes, thermomechanical characterisation, advanced models and numerical simulation



- Multi-axial tests under monotonic or fatigue loading (specimens and structures)
- Full field measurements (kinematic, thermal, and tomography)
- Microcracking damage study
- Dynamics: vibrations, impact and crash
- Machining and cutting processes
- Modelling and numerical simulation of structures, systems and manufacturing processes
- Topological optimization and additive manufacturing
- Fabric characterization and forming process



RESEARCH INTERESTS

MECHANICAL CHARACTERIZATION, IDENTIFICATION AND FULL FIELD MEASUREMENTS

- Combining of kinematic and thermal field measurements
- Experimental approach of heterogeneous fieldsDIC characterization, X-ray tomography, digital
- volume correlation
- Finite element model updating

BEHAVIOUR OF MATERIAL AND DAMAGE COUPLING

- Modelling of coupling process
- Long-term integrity analysis
- Reliability study in electronic packaging and seismics

THERMO-MECHANICAL BEHAVIOUR OF HETEROGENEOUS ASSEMBLIES

• Characterization and modelling of compounds and interfaces

• In situ behaviour of small systems

MODELING AND OPTIMIZATION OF PROCESSES

- Modelling of manufacturing processes
- Composite forming process
- Development of bio-based reinforcement textile
- materials for composites and geotextiles
- Metallic Additive Layer Manufacturing





Calculation tools

- Abaqus, Samcef, Nastran, Comsol, Fluent
- Multiprocessor parallel computing servers

Experimental tools

- Gas gun for impact tests
- Mechanical testing machines
- Biaxial fatigue machine
- Vibration analysis benches
- High speed machining, 3 and 5 axes
- SLM additive manufacturing machines (metal), Extraction, spinning and fabric reinforcement implementation

Measuring equipment

- Correlation and stereo correlation (quasi-static and high speed measures)
- Infrared thermography
- 3D digitization
- X-ray tomography
- Laser velocimetry
- Actarus cutting temperature measurement
- Cutting forces and power measurement



GG The research activities of M2SP group are based on the coupling of experimental and numerical methods to better understand the thermomechanical behaviour of structures and processes. »

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6





PROJECTS AND PARTNERSHIP

INTERNATIONAL

• HORIZON 2020 SSUCHY: Biopolymers with advanced

- functionalities for high performance applications
- POCTEFA POCRISC: For a common culture of seismic risk
- HORIZON 2020 ENABLE: Industrial processes Friction Stir Welding, Machining

REGIONALS

• AEROSAT SEMIR: Development of a simulation based tool for thermosetting reinforcements or thermoplastic materials forming

• READYNOV RESMACC: Energy transition - from

development of renewable energies to industrial change • READYNOV GEOFIBNET: Territorial Agro-food production and biomass valorisation

• FUI WASPE (IMF/M2SP): Weight saving for aeronautic structures: power and control electronic package

• CORAC GENOME (IMF/M2SP): polymer durability

INDUSTRIAL PARTNERSHIPS

 CIFRE SAFRAN ED: Fatigue life prediction methodologies of SAC305 assemblies subjected to thermal and vibrational loadings
 CIFRE HALBRONN: Development of simplified approaches for simulation and validation of performance in metal powder bed additive manufacturing

CIFRE STANEO: Detection and characterization of building damage caused by seismic events

• CIFRE HÉPHAÏSTOS-COUSSO: Development of a methodology for additive manufacturing in a context of manufacturing metal pieces by machining

DIDS GROUP

DECISION AND INTEROPERABILITY FOR DYNAMIC SYSTEMS

DIDS' work focuses on controlled dynamic systems.



Methodological breakthroughs

- Distributed supervision, control, simulation and planning
- Ontology modeling and semantic integration
- Immersive and interactive task and motion planning
- Human-robot interaction
- Macroscopic representation of electromagnetic and multi-physical interactions
- Modulation and observation strategies for power converters
- Asymptotic or non-asymptotic estimators
- Ultra-local control of model





- Design of dedicated architectures
- Interoperable architectures
- Optimal integration
- Distributed control, diagnosis and prognosis
- Cooperation of decision-making bodies

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DISTRIBUTED DYNAMIC DECISION

- Simulations, performance assessments, (re)planning and interoperability
- Diagnosis, prognosis and control
- Semantics, knowledge and ontologies



FUNCTIONAL OPTIMIZATION OF MECHATRONIC SYSTEMS

- Modulated control of power converters
- Modeling of multi-physical systems : from
- thermomechanical to electromagnetic behavior
- Integration and optimization of converters







ESTIMATION AND CONTROL

- Design methods for minimal observers
- Adaptive methods for estimation and control
- System identification

ROBOTICS, VIRTUAL REALITY AND VISION

- Motion planning and visuo-haptic guidance in Virtual Reality
- Vision for robotics, algorithm-architecture adequacy and $\ensuremath{\mathsf{HW}}\xspace/\ensuremath{\mathsf{SW}}\xspace$ co-design
- Human-robot collaboration
- Biomechanical and musculoskeletal system



- Distributed scheduling tool **e-R@mses**
- Distributed interactive simulation platforms: E-HLA, SIMBA, Witness, Arena, Visibroker, Pitch RTI
- Calculation and simulation software: Scilab. Matlab. R
- Virtual reality platform: Interactive and immersive simulation
- Mechatronic systems integration platform

8

DIDS activities deal with modeling, simulation, command, monitoring, supervision and control of complex systems. These systems are considered either as a separate entity or as systems within systems interacting in complex environments that may involve human beings. »

Pr. Xavier Desforges



INTERNATIONALS

• PHC PREDICAT: A semantic platform for data interoperability and linking in earth observation and disaster prediction

NATIONALS

• ANR CAPTIF: innovative integrated sensors and software in the kernel of power systems

REGIONALS

• CLE CONVERSION'99: development of a new range of very high efficiency aeronautical electrical converters (distribution of electrical energy to passengers in the new ECO PREMIUM aircraft cabins)

• EASYNOV POLARISC: Operational Platform for Updating Inter-Service Intelligence for Civil Security

• MASIPES: Development of strategies for the resilience of river subjected to surface pollution

INDUSTRIAL PARTNERSHIPS

CIFRE CACG: Cooperation of hydraulic and delay graph-based models for flood protection
CIFRE ALSTOM: Characterization and improvement of models on a real-time simulator of rail traction chain

SDC GROUP DECISION SUPPORT AND COGNITIVE SYSTEMS

Fully aware of the consequences....



The activities of the SDC team focus on the organization, improvement and management of complex systems. The research activities aim to measure and control the efficiency of these systems by analysing or processing the intangible assets represented by data, information or knowledge. Their treatment leads to the generation of higher-level knowledge useful for supporting decision-making in multi-criteria, multi-scale and highly dynamic contexts.



Tools and techniques

• Methods for modelling degradation, estimating health status, predicting useful residual life

- Detection and diagnostic methods
- Methods for decision-making modelisation (probabilistic, possibilistic and evidential frameworks)
 Problem solving methods and feedback

• Decision modelling methods and evaluation techniques (multi-agent systems, BOCR, game theory, multi-criteria decision-making)

- Combinatorial optimization methods (heuristics and metaheuristics)
- Knowledge engineering (case-based reasoning, conceptual graphs)
- Competence Management

For more information:

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EXPERIENCE, KNOWLEDGE, SKILLS

This theme addresses knowledge production and its use in improving systems and services.

Experience

- Capitalization and reuse of design assets
- Problem solving and feedback systems
- Linking experience and knowledge

Knowledge

- Formalization of standard documents
- Solving conflicts associated with multi-expert knowledge
 Skills
- Definition of "operational management skills" models
- Identification and management of operational skills

UNCERTAINTIES, RISKS AND PROGNOSIS

This theme addresses improvements in decision-making through better assessment of the risks involved and the prognosis for the progression of the system.

Uncertainties

- Modelling and exploitation of knowledge uncertainly
- Propagation of uncertainties for defining confidence intervals
 Bisks
- Design of indicators for assessing risk levels (sources of danger)
- Characterization of vulnerability measures (target of danger)

Prognostics

- Prognostics of system-oriented failure
- Prediction of Remaining Useful Life
- Post-prognostics decision support



Industrial tools and techniques

- ERP (SAP)
- Data Mining (Rapid Miner)
- RAMS Study platform
- Problem solving methods and lesson learnt systems
 Process Modelling (BPMN)
- Prognostics & Health Management (detection, diagnostics, prognostics)

Transfer

- Dedicated software resulting from research actions
- GEO-C software (Operational Management of
- Competences)
- ProWhy software (problem solving and lesson learnt)



GG The activities of the SDC team concern the definition and evaluation of models, tools and methodologies for improving the quality of the organization and management of sociotechnical systems. »

Pr. François Pérès





INTERNATIONAL

• SMART (POCTEFA): Intelligent monitoring for prédictive maintenance of industrial systems

• H2020 Roll2Rail: Contribution of the Bayesian approach to the definition of a reliability model for an IGBT module in a railway environment

NATIONAL

• ANR OPERA: Software platform to evaluate a response to calls for tenders (models, ontologies, algorithms for probabilistic evaluation of the feasibility of solution architectures)

• FUI 2Pi-MCO: Improving the productivity of SMEs in electrical engineering for optimized maintenance and design

• FUI TIMM: Design and marketing of the first mobile medical teleimaging unit connected in real time with an expert medical centre to fight against medical desertification and promote home support

REGIONAL

• IDEX MINDOC: Information Modelling for the development of sustainable construction

• EASYNOV RESPRO 2.0: Problem solving for the factory of the future

• EauPure: Assessment and prediction of water quality in the Adour territory based on data processing and analysis

• APR MERCI: Causal model for flood risk assessment

• APR VESTA: Decision support for earthquake vulnerability analysis of infrastructure networks

INDUSTRIAL

• CIFRE ALSTOM: Development of a method for analysing the ageing of traction auxiliary motors in the railway sector

• CIFRE AXSENS: Collaboration models in industrial processes. Consideration of collaboration for the association of actors/ activities based on experience

• CIFRE Worldcast Systems: Monitoring, diagnostic and prognostics of failures in broadcasting systems

• CEA: Diagnosis and prognosis of defects in wired networks of complex transport systems



Remarkable transdisciplinary activities involving several LGP groups.

MACHINED SURFACES - MATERIAL AND MACHINE

This research activity is positioned at distinct levels and takes • Modeling of vibration phenomena in surface in both upstream work (towards a better understanding and characterization of phenomena) and to applied research for industrial purposes (higher TRL, patents), with strong interactions and reciprocal support.

SERVICES

They are mainly focused on the study of manufacturing processes:

 Characterization of cutting and cutting phenomena rapid deformation (welding-mixing), by identifying behavioural laws, by implementing innovative experiments, field measurements and physical quantities related to the process

 Identification of the impact of constraints and disturbances on the surface integrity of machined parts in materials with reduced machinability or in contact at high **For more information**: speed, tribology under severe conditions

NATURAL RISKS

The notion of natural risk covers all the threats that certain natural phenomena and hazards pose to populations, structures and facilities. More or less violent, these events which can be more or less violent are always likely to be dangerous from a human, economic orenvironmental point of view. The prevention of natural hazards consists in adapting to these phenomena in order to reduce, as far as possible, their foreseeable consequences and potential damage.

On a local level, the Hautes-Pyrénées department is particularly exposed to major risks, both in the south in of prevention or protection strategies, mountainous areas and in the north in lowland areas. In addition, virtually the whole of the Hautes-Pyrénées department is at risk from seismic activity and has the highest seismicity rate in the country.

In these two distinct landscapes, the way of the territory is occupied subjects people and property to very specific major risks (flooding by torrential flooding, ground movement, avalanche, forest fires).

machining for process optimization

• Dynamic behaviour of systems, such as machine tools or robotic structures, under high loads and on machining or welding-mixing (FSW) processes

· Development of process monitoring solutions for machining (based on data mining and tool wear detection probabilities) and robotisized finishing

ACADEMIC INTERACTIONS

ICA Toulouse (cutting and multi-materials), I2M Bordeaux (laws of behaviour), LABOMAP Cluny, Universities of Zhytomyr and Barcelona, ENI of Sfax (Tunisia)

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SERVICES

- Reliable design
- Numerical modeling
- Study of the behaviour of applied structures (reinforcement of old buildings, construction of reinforcement dikes),
- Characterization of damage levels

• Risk management, decision help, propagation of uncertainties or assessment of vulnerability levels (prediction of known dangers), implementation crisis management

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Resources and Skills Centres

Exceptional equipment is used in material-mechanical-processes, power electronics activities, robotization, Factory of the Future, composites and ALM (Additive Layer Manufacturing) ...

ENIT provides technical and human resources to carry out training, research and transfer missions, including two Resource and Skills Centres within the establishment: CIMMES and IDCE.

ENGINEERING CENTRE IN MECHANICS, MATERIALS AND SURFACES

This centre brings together the equipment used for the research work of the IMF and M2SP teams and also reflects ENIT's will to make its research available to industry, in the fields of mechanics, materials, treatments and surface analysis.

SERVICES IN MATERIALS AND MECHANICS

 Techniques for manufacturers such as advice, expertise. analysis, controls and tests

• R&D to acquire the knowledge necessary for scientific and technological improvement or innovation

ENGINEERING OF DECISION AND COMMUNICATION FOR COMPANIES

This service supports research and development activities in three areas of information and communication technologies.

The CRC-IDCE is developing in three major areas:

• Support for research projects which have extremely diverse objectives but share a need for the development of specific complex software

• Promoting research in companies through the development of software packages from the LGP and software that can be promoted in industry, such as the ProWhy software package

Accelerating and transferring technologies to

companies through performance evaluation, simulation, flow management, virtual reality, vision and robotics





► For more information:

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SERVICES FOR ACCELERATION AND TECH-**NOLOGY TRANSFER TO COMPANIES**

The services offered to companies are:

• The know-how and expertise of CRC-IDCE engineers in the field of software development using modern technologies

• Software tools developed and distributed by the CRC-IDCE in collaboration with the LGP



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PLATFORMS

- ENIT provides technical and human resources to carry out its training, research and transfer missions, including:
- 2 platforms located outside the university campus: PRIMES (65 Tarbes) and METALLICADOUR (64 Bordes);
- 2 platforms under development: CRTCI and CEF3D (Tarbes campus).

PLATFORM FOR RESEARCH ON POWER INTEGRATION AND ENERGY MANAGEMENT OF STORAGE COMPONENTS

The PRIMES platform strives to implement a network of skateholders in the sectors of power integration, mechatronics (synergistic combination of mechanics, electronics and real-time information) and energy and systems management, by bringing together public research laboratories and private companies in a single space proivided with design, simulation, prototyping, characterization and testing resources.

SERVICES

Tests, advice, analysis, expertise, technological assistance, control, research contracts.

AVAILABLE EQUIPMENT

- Design and multi-physical simulation platform
- High power electrical tests and trials
- 250 m² iso5/7 insulated clean room with pilot line and prototyping
- Characterization and reliability facilities
- Non-destructive testing facilities (acoustic
- microscope, digital and mocrotomography RX3D)
- Combined stress bench (1 m³)
- Anechoic chamber

▶ For more information:

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TECHNOLOGY TRANSFER PLATFORM: MACHINING, ROBOTIZATION, FSW AND OTHER ASSEMBLY TECHNIQUES

The Metallicadour platform strives to facilitate interactions between industry and academics in research, transfer and training activities in close proximity to the skateholders.

The centre, which has been in operation since 2015, houses high-performance industrial equipment in a 1000 m² technology hall and addresses high-performance machining problems of materials with low machinability, machining assistance, machined surface integrity, robotic finishing and machining, robotic friction stir welding (FSW) and robotic MIG-TIG welding, CMT additive manufacturing and robotic dimensional inspection.

SERVICES

Tests, advice, analysis, expertise, assistance technological strategy R&D strategy (CIR approval), control and training.

AVAILABLE EQUIPMENT

- Machining facilities (MORI SEIKI NMV5000 5-axis machining centre 20 000 rpm, NT3200 hard materials turning centre)
- Cutting assistance facilities (micro-lubrication, high pressure lubrication 300 bars, vibratory drilling, cryogenics)
- Measuring equipment during machining or in the vicinity (KISTLER, ALICONA, RAYBOT...)
- KUKA KR500 6-axis high-volume welding robot with 7th linear axis with FSW, MIG, TIG and MIG-CMT effectors
- ABB robots 6660 6620 2400 6-axis and rotary table with finishing and machining effectors (from 1,000 to 60,000 rpm), PR deposit, passive and active compliances, dimensional and geometric control

• DELCAM and NX10 CAM chain and supervision



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A RESOURCE AND TRANSFER CENTRE FOR COMPOSITE AND INNOVATIVE PROCESSES

This research activity is intended for the transformation of bio-sourced fibres throughout their life cycle in order to promote the economic development and innovation in a materials and structures sector in the Occitania Region.

SERVICES

Four research themes are highlighted in the following issues:

• Extraction of fibres from vegetable materials: maximize yields, separate the various elements that can be exploited, and minimize the impact of extraction on the mechanical and morphological properties of the fibre.

ADDITIVE MANUFACTURING ON METALLIC POWDER BED

The LGP, with its reputation for multidisciplinarity, innovations, has creates a Shared Research Structure («SMR», financed by the Occitania Region) for additive manufacturing on metallic powderbed.

SERVICES

- Design of parts
- Machine runability and finishing
- Analysis of microstructure and metallurgy generated by laser fusion
- Numerical simulations and advanced laws of material behaviour
- Characterization of mechanical properties

FOUNDING PARTNERS

Halbronn, ESI-Group, Héphaïstos Group, ENIT, Région Occitanie



• Textile architecture: create families of yarn which can be optimized for various types of reinforcement composites and geotextiles as well as prototypes of woven textiles

• Textile characterization and formability: determining the deformability of textiles, defining, understanding and minimizing formatting defects

• Fibre and composite recycling: re-architecturing of recycled fibres, multiple re-use of thermoplastic composites

For more information:

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SPECIAL EQUIPMENT

• Tests: two additive manufacturing machines using laser fusion on a metal powder bed, one thermomechanical test machine ("Gleeble" type machine)

• Analysis: equipment of the MFI team and the CRC CIMMES

