

TRAINING – PHD AND MASTERS' PROGRAMS

The DRIVE laboratory is hosted by ISAT, a renowned French engineering school. As such, research and teaching are entwined which translates into how both structures operate. Training departments and research thematic areas are closely aligned. The researchers provide the students with access to their skills and knowledge at all stages of the training process, be it engineer degree or masters' programs: MEETING research master program in mechanics and engineering, co-accredited with the university of Franche Comté and the Ecole Nationale Supérieure de Micro Mécanique of Besançon; AESM Automotive Engineering for Sustainable Mobility Master program co-accredited with the university of Orléans.

The DRIVE research laboratory collaborates with ca. 20 Phd students on laboratory- or funded projects. The research community offers many internships for master- as well as international Phd programs.

TECHNOLOGY TRANSFER



The DRIVE laboratory and partner SAYENS both shape the innovative roadmaps by providing service provision geared to detecting, evaluating innovations and supporting them all through their way to business set-up.

WHEN RESEARCH AND INDUSTRY MEET



Research office

Sidi-Mohammed SENOUCI, Professor,
Director DRIVE laboratory
direction.drive@u-bourgogne.fr

Martine AIMÉ, Assistant:
+33 3 86 71 50 18
secretariat.drive@u-bourgogne.fr

DRIVE Research Laboratory

Institut Supérieur de l'Automobile
et des Transports ISAT
49, rue Mademoiselle Bourgeois
BP 31 - F 58027 NEVERS Cedex
<https://drive.u-bourgogne.fr/> (in progress)
www.isat.fr/recherche



Research in vehicle engineering for the environment

MATERIALS, COMFORT, ENERGY & INTELLIGENCE

To serve smart mobility in tomorrow's smart cities



Credit photo : © ISAT, CHEZIERE.

The DRIVE research laboratory of the University of Bourgogne is located in Nevers Magny-Cours in France. Staffed by ca. 60 community members of which ca. 30 researchers and ca. 20 PhD. students, the DRIVE laboratory develops high-level applied and fundamental research with cutting-edge equipment. The research work encompasses 2 areas of specialism: intelligent systems with energy optimization as well as mechanics of materials and structures.

The laboratory is composed of **2 teams** each focusing on **2 domains**:

- ▶ **MECHANICS AND ACOUSTICS FOR TRANSPORT (MAT)**
Durability and Composite Structures (DSC)
Vibration and Acoustics in Transport (VAT)
- ▶ **ENERGY, MOBILITY, INTELLIGENCE AND ENVIRONMENT (EMIE)**
Mobility, Energy, Environment, Powertrain (MEEP)
Intelligent & Connected Systems (SIC)



Team

MECHANICS AND ACOUSTICS FOR TRANSPORT

Durability and Composite Structures

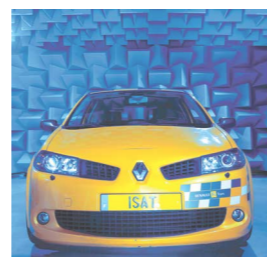
Research in this key area addresses the concept of the life cycle of composite structures, from the core material to recycling, including assembling and ageing. The projects encompass weight- and cost-reduction, safety upgrading, global performance and reliability of composite systems in sustainable mobility applications, be it transport means or street furniture. These research activities particularly focus on characterizing the lifespan of these composite structures by testing their resilience to nominal or accidental mechanical loads and to hygrothermal conditions prevailing in their environment.



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| Application areas | - Assembly of composite structures - Weight-reduction of structures | - Street furniture for sustainable cities |
| Resources | - Static and dynamic mechanical testing machines (tensile, fatigue, shock, drop-tower...) - Composite manufacturing: hot press, stoves, autoclave, 3D printer, laser cutting | - Control and inspection means: electron & digital microscopy, acoustic emission, ultrasounds, infrared scan, high-speed camera - Non Destructive Tests: acoustic emissions, ultrasounds, infrared scan |
| Expertise | - Hygrothermal mechanical behaviour characterisation of composite structures | - Bonded assemblies' mechanics - Development of novel bio-sourced materials |
| Implementation examples | - Bonded assemblies for the automotive and rail industry - Energy-absorbing hybrid composite structures linen fiber/carbon/epoxy for the automobile competition | - Design and development of long-term multidevice creep testing |

Vibration and Acoustics for Transport

This research team focuses on high-potential scientific and technological studies of vibroacoustic properties of structures used for transportation. Activities in progress aim at including complex materials in vibratory and acoustical passive control applications (rubber type viscoelastic-constrained dampening materials or complex materials for sound absorption such as air-saturated porous, fibrous, granular, micro-perforated materials...).



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| Application areas | - Transport and infrastructures - Materials for acoustical and vibratory comfort |
| Resources | - Impedance tube, spectrum analyzer, microphones, acoustic holography - Material characterization techniques (porosimeter, air ultrasonic sensors, airflow resistivity meter, ...) - Laser vibrometer, shaker units, accelerometers, high-frequency thermal camera - Semi anechoic chamber, reverberation chamber |
| Expertise | - Mechanical properties of exhaust systems' components (Volvo Trucks) - Insulation and absorption properties of materials for PSA - LOOK Cycles, SYMBIO - Vibro-acoustics training for Electrolux |
| Implementation examples | - Low thickness perforated mille-feuille acoustic resonator for absorbing or radiating very low acoustic frequencies – Patent W02017134125A1, 10 Aug. 2017 |

Team

ENERGY, MOBILITY, INTELLIGENCE & ENVIRONMENT

Mobility, Energy, Environment, Powertrain

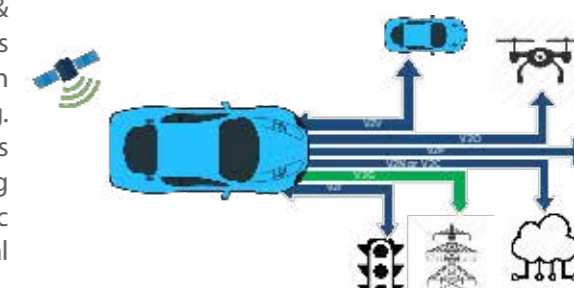
With experts in combustion, complex and reactive fluids mechanics, engine management, fuel cells and standard or hybrid powertrain issues, the team addresses real-life challenges such as reduction of CO2, powertrain efficiency, reduction of pollutants in transport and upgrading the environmental impact of powertrains.



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| Application areas | - Combustion chambers and alternative fuels - Novel powertrains, hybrid solutions | - Aerodynamics, hydrodynamics - Emissions' control |
| Resources | - Dynamic test benches for engines and powertrains (engine, fuel cell, hybrid) - Dynamic test benches for complete vehicles (1 to 4 wheels) - High pressure and temperature Shock tube | - Optical methods (PIV, spectrometrics, speed camera, high speed infrared camera) - Computing cluster and digital simulation in fluid mechanics (RANS, LES, DNS) |
| Expertise | - Engine control, combustion, injection, pollutants build-up - Hybridation, fuel efficiency, pollution | - Optimal design, aerodynamics |
| Implementation examples | - 5-stroke engine, Stirling engine (Danielson Engineering) - Injection models (Renault) - Alternative fuels (HHO Hydrogene) - Dieselgate (Ministry of Justice) | - Bio-fuels characterization (Government of Malaysia) - Hybrid vehicle energy optimization with roadmap anticipation (Danielson Engineering, Sodemo) |

Intelligent and Connected systems

Researchers on this area carry out activities on Information & Communication Technology applied to intelligent & autonomous vehicles, Internet of Things and SmartGrid. The research work focuses on data collection optimization, secure data exchange and data processing. Our activities are carried out through the development of solutions (algorithms and protocols) most often based on analytical modelling (game theory, multi-objective optimization, automatic learning, genetic algorithms, etc.) supported by both experimental and numerical simulation expertise.



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| Application areas | - Intelligent and autonomous vehicle - Internet of Things | - SmartGrid - Electric and hybrid vehicle |
| Resources | - 2 autonomous electric vehicles - Driving simulator | - Fleet of drones and robots - Indoor and outdoor (GPS RTK) localization systems |
| Expertise | - Mathematical optimization and modelling - Cybersecurity (intrusion detection, access control, authentication...) - Development of embedded software (image processing, object recognition...) | - Batteries & communications networks simulation and modelling - Android development - Test beds & proof of concepts development |
| Implementation examples | - Android applications (economical route planning, pedestrian safety using smartphones, etc.) - GLOSA (Green Light Optimal Speed Advice) algorithm - Optimization algorithm that selects the best source of energy in an intelligent building | - Charging station deployment model in a smart city - Security algorithm for smart hotel with proof of concept development - Object detection algorithms using an embedded camera on a moving vehicle (drone, ship) |