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The University of Liège has a long tradition in aeronautics within the Faculty of Applied Sciences, shared between three departments and one research center: Department of Aerospace and Mechanical Engineering (A&M), Urban & Environmental Engineering (UEE), Department of Electrical Engineering and Computer Science (EEI Montefiore) and Centre Spatial de Liège (CSL). Various skills are offered and available.

A&M Department

The **Aeroelasticity and Experimental Aerodynamics Research Group** of the University of Liège carries out internationally recognized research in the fields of aeroelasticity, experimental aerodynamics and fluid-structure interaction. Applications include air vehicles, civil engineering structures and land vehicles.

The research group collaborates closely with the University's large, closed return multidisciplinary low speed wind tunnel. It has two working sections, with a maximum cross-sectional area of 2.5x1.8m (width x height) and a maximum airspeed of 60m/s. (www.ltas-aea.ulg.ac.be)

The **Computational & Multi-scale Mechanics of Materials research unit** [CM3] focuses on the developments of multi-scale numerical methods for complex non-linear engineered materials, such as the failure study of composites, foamed materials, and MEMS. The research is achieved through international collaborations with other universities, research centers, and industries; it is financed through national and European projects. (www.ltas-cm3.ulg.ac.be)

The **Metallic Materials Science Unit** (MMS) studies the physico-chemical phenomena that governs optimization of metallic materials and determines their properties.

The main focus is concerning thermal treatments, phase transformations at liquid and solid state for aeronautical alloys (Al, Ni, Ti, special steels) and thermophysical properties.

The MMS researches concerns also microstructure obtained through particular processes such as: thix-forming, vacuum coating and deposition of thin foils, friction stir processing, laser cladding, electron beam melting, powder metallurgy. (www.metaux.ulg.ac.be)
Current research activities of the Aerospace & Mechanical Department Turbomachinery Group are applied thermodynamics, simulation of flows in turbomachines and aircraft engine health monitoring. (www2.ulg.ac.be/turbo)

The **Computer Aided Geometrical Design group** is active in research in CAD/CAM/CAE and the link with novel numerical simulation techniques. Among our research topics, the following have applications in aeronautics:

- Novel simulation techniques like the Extended Finite Element Method [X-FEM]
- Application of the X-FEM to the simulation of composite structures (structural analysis or manufacturing techniques)
- Structural analysis-driven automatic model simplification
- Mesh Generation for numerical simulations (www.cgeo.ulg.ac.be)

LTAS-Computational Mechanics specializes in tailored software developments and numerical simulation of problems involving large deformations, complex contact situations and multi-physics couplings.

Our finite element based software METAFOR can deal with complex material behaviors including damage and fracture propagation for both metallic and composite materials. Domains of application are:

- Impact simulation and crashworthiness
- Hot and cold metal forming processes
- Tire mechanics & rubber.
- Biomechanics

These numerical models result from many collaborative projects with industry and funded by the European Community, the Walloon Region and the Marshall Plan. (www.ltas-mnl.ulg.ac.be)

The field of expertise of the “**Vibration et Identification des Structures**” (LTAS-VIS) research group relies in the theoretical and experimental dynamic analysis of jet engine mechanical components. The main topics on which LTAS-VIS has developed a strong research expertise are the following:

- Structural design of aircraft engines;
- Turbomachinery rotordynamics;
- Vibration testing and modal analysis.

Research developments are performed with the aim of implementation in industrial finite element programs such as Samcef and/or Oofelie. Experimental activities are closely related to the setting-up of vibration testing facilities (www.ltas-vis.ulg.ac.be)

Urban & Environmental Engineering (UEE)

The **Laboratory of Materials and Structures Mechanics (M&S)** offers possibilities for aeronautical firms to carry out mechanical tests on different types of aircraft components like rods, lubrication groups, bearing supports, flaps actuator parts, engines composite or metallic carters. The equipment park includes hydraulic and electro-mechanic machines with a load capacity from 10 kN to 2500 kN. On a test floor, movable static hydraulic jacks (50 to 1000 kN) and movable dynamic hydraulic jacks (100 to 1000 kN) can be used. Collaborating with M&S laboratory; **MSM team (Materials and Solid Mechanics)** focuses on material models (steel, Ti, Al...). Development and identification of constitutive thermo-mechanical-metallurgical laws rely on macroscopic phenomenological or multi-scale approaches and crystal plasticity models. Implemented within FEM codes, these laws predict stress, strain, and damage fields during forming processes, specific static or cyclic loading cases. Since 1984, MSM team has developed its own non linear finite element code **Lagamine**.

(www.uee.ulg.ac.be/cms/c_2672632/fr/mecanique-des-solides-et-des-materiaux-msm,
www.uee.ulg.ac.be/cms/c_2371593/fr/laboratoire-des-materiaux-et-des-structures-mecaniques)

EEI-Montefiore Department

Applied and Computational Electromagnetics (ACE) group: Electromagnetic Compatibility (EMC) tests according to MIL STD 461 (D/E/F) and RTCA DO 160 in reverberating and semi-anechoic rooms. Modeling of electromagnetic systems from statics and quasistatics to wave scattering and optics.

(ace.montefiore.ulg.ac.be)

The main research fields of **Microsys laboratory** are the exploratory R&D in the field of microsystem and the energy harvesting or scavenging systems. Microsys conducts inter-disciplinary and cross-disciplinary innovative research in edge-cut fields:

- Exploratory R&D in the field of microsystem R&D in the field of micro-assembly, packaging and interconnect technology
- Microsystem design using off-the-shelf sensors and components, including packaged and bare die
- Pathfinding research on Energy harvesting and scavenging

Microsys is involved in the design and integration of ultra low power wireless sensor microsystems for structural health monitoring and environment sensing in harsh conditions. (www.microsys.ulg.ac.be)

Centre Spatial de Liège

Centre Spatial de Liège (CSL) is an Applied Research Centre of the University of Liège, Belgium dedicated to space in relation with the most prestigious space agencies such as ESA, NASA, JAXA, CNES, CONAE... Relying on 90 highly skilled and passionate people, CSL develops, assemble, calibrate and/or test unique instruments and systems capable to operate in the harsh environment of deep space.

CSL is also an actor for the economical deployment of the region through a dynamic participation to technological and data processing application projects with the industry (www.csl.ulg.ac.be)

