International students traineeship offer

Université Polytechnique Hauts-de-France (UPHF) is a transdisciplinary institution, it encourages the cross-fertilization of its faculties and research laboratories. The university has a research policy that strengthens, the link with education and, the development of transfer activities. It is recognized as a regional and national pillar and is internationally recognized, for research excellence in the field of sustainable transport and mobility. This strategy is developed within international excellence networks and strategic partners like the Lille Universitary Federation, the EUNICE Alliance (European University), and regional non-academic partners, including Valenciennes hospital.

UPHF counts four research laboratories: **LAMIH UMR – CNRS 8201** (human beings and cyber-physical systems, smart interactions and coupling, extreme conditions, adaptability and intelligence, stabilisation and improvement of mobility, physical activity for rehabilitation, embedded motion capture), **CERAMATHS** (bioactive ceramics, ceramization and innovative processes, geometry and global analysis, cryptography, probabilities, statistics, big data, artificial intelligence, computer-aided geometric design, popularisation history and algebra), **IEMN UMR – CNRS 8520** (digital communications, micro and nanosystems, ultrasonic control and charracterisation, acousto-optic systems, optronics) and **LARSH** (territories, organizations and society, identities, digital humanities).

The traineeship offer below is within the **LAMIH UMR – CNRS 8201** (Laboratory of Industrial and Human Automation, Mechanics and Computer Science). It is a joint research unit between the Université Polytechnique Hauts de France (UPHF) and the "Centre National de la Recherche Scientifique (CNRS)", a national research center led by the bests in their fields. It is divided into 4 departments with a total of nearly 250 researchers, engineers and research support staff, both permanent and non-permanent: Automatics, Mechanics, Computer Science and Human and Life Sciences (SHV).

UPHF is located in Valenciennes in the North of France, at the heart of the European metropolis. From the region, you can reach multiple capital cities in less than 4 hours such as Brussels, London or Amsterdam. At UPHF, a tenth of the students are international students from more than 85 countries. The intercultural ambiance is present everywhere on campus and even more during the day trips organized during the year for exchange students by the International Office (available depending on the dates of the internship).Valenciennes is the second largest student city in the region, you will find everything there… except the disadvantages of big cities! So why not join UPHF as a intern?

Position title	**High-Strain Rate Response of Multi-Material Hollow Lattice Metamaterials**
Research laboratory	LAMIH UMR – CNRS 8201
Location	Université Polytechnique Hauts-de-France – Le Mont Houy 59313 Valenciennes Cedex 9, France
Project	**General Context:** Architectured lattices are growing significant interest in various sectors (aerospace, aeronautic, biomedical, defence) due to their high stiffness-to-weight ratio, energy absorption capabilities, and functional adaptability through geometric design. The rise of additive manufacturing now enables the fabrication of complex geometries that are inaccessible by traditional methods, including hollow cylindrical lattices and multi-material compositions. These structures can be precisely filled with different topologies as well as material gradations to control specific mechanical responses and collapse mechanisms. **Current Challenges:** Few studies have investigated the compressive behaviour of hollow cylindrical composites lattices under high dynamic loading conditions. The influence of geometry (thickness, relative density, topology), the presence of different materials or topologies, inertial effects and loading rate sensitivity on collapse mechanisms remain poorly understood, modelled and predicted. Improved knowledge of the influence of geometric parameters, as well as loading rate effects, would assist in the optimization of shock energy absorption and impact protection systems design. **Scientific Objectives:** • Investigate the mechanical behaviour of hollow cylindrical lattices under static and dynamic compression conditions. • Quantify the contribution of infill specimens. • Understand the influence of topology; relative density, based materials (mono vs. multi-materials) and loading rate.

	• Develop an experimental characterization approach coupled with numerical modelling to predict and optimize their mechanical responses.
Start date	October 2025
End date	April 2026
Number of weeks	24 weeks
Internship bonus	Legal minimum bonus for an internship (appr. 600€/month)
Advantages	• Students card with all the benefits • Room reservation • French lessons free of charge • Immersion in the research field
List of responsibilities/ missions	**Research Methodology** **Design and Fabrication** • Parametric CAD design of hollow cylindrical lattices with geometric variability (unit cells, effective surface, relative density). • Integration of multi-material architectures: combinations of polymers, metallic alloys or granular. • Manufacturing via 3D printing process with quality control through tomography or microscopy. **Experimental Characterization (excluding base material properties)** Quasi-static compression (1–10 mm/min): • Low strain-rate tests, measurement of force/crushing curves and local strain using Digital Image Correlation (DIC). High loading rate compression (~15 m/s): • Split Hopkinson Pressure Bar (SHPB) tests to calculate force/crushing curves using governing equations. • High-speed or ultra-high-speed imaging for real-time visualization of deformation modes, localization, buckling, and quantitative strain analysis via DIC. Observations of collapse mechanisms using Post-mortem physical cut. **Finite Element Modelling and Numerical Simulation** • Finite element models incorporating non-linear material behaviour, contact mechanics, large deformations formulation and visco-plasticity. • Simulation and analysis of both local and global collapse mechanisms. • Development of digital twins for predicting the collapse behaviour of composite lattice structures.

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