

## Proposal for a PhD Fellowship (3-year Working Contract)

To apply, send an email to: [georges.zissis@laplace.univ-tlse.fr](mailto:georges.zissis@laplace.univ-tlse.fr)

- a. Detailed CV
- b. Cover letter
- c. Name and contact details (email, telephone) of a contact person

**Deadline for receipt of applications: June 10, 2024**

**Doctoral School:** Electrical, Electronic, Telecommunications and Health Engineering (GEETS)

**Thesis start date:** 1 October 2024

**Thesis supervisor:** Georges ZISSIS, PR, LAPLACE

**Co-supervisor:** Laurent CANALE, IR CNRS, LAPLACE

**Location:** Laboratoire LAPLACE, Univ. Toulouse III, 118 rte de Narbonne, Toulouse, France

### Subject

#### ***Creation of a Digital Twin for the evaluation of the efficiency and management of a smart lighting system***

#### **Presentation of the topic:**

As Solid Light Sources' (SSL) technology evolves, maximizing the energy savings, connected SSL systems will increasingly depend on successful integration into the overall environment (city, building, vehicle, etc.). So, today, we are seeing a transition from conventional "analog" lighting technologies to "digital" smart lighting at the heart of the "Internet of Things". It is thus expected that smart lighting will become the backbone of complex digital systems in which optimization and control are vital elements. In addition, we are now witnessing the development of digital platforms that simulate the behaviors of systems that are used to monitor and adapt them in real time to users' needs. They also contribute to strengthening their resilience by anticipating failures. The concept of a "digital twin" (DT) perfectly meets these requirements. It consists of the virtual representation of a system, used for the design, simulation, monitoring, optimization or maintenance of the system. Integrate smart lighting systems into such platforms has never been attempted until now, either at the level of buildings or cities. The objective of this work is to explore the possibility of using DTs for the digital representation of smart lighting system. This requires an understanding of the physics of the system and its components, but also of its life cycle and its applications in interaction with its users.

The objective of this thesis is to set up an embryonic DT platform (e.g. inside Unity) with the ability to manage virtual or augmented reality and which will include the knowledge of lighting system physics mastered by LAPLACE. This thesis is part of the strengthening of the activities of the Lumière & Matière group in the field of lighting systems by contributing to the creation of a new activity around intelligent and connected lighting systems.

#### **Candidate's Profile sought:**

The candidate must have a confirmed scientific profile (rigor, curiosity, autonomy, etc.).

His/her initial training shall be in Engineering Science and can be related to a wide range of disciplines: Systems Engineering and their modeling, Artificial Intelligence and Machine Learning, image processing, visualization and virtual reality. Knowledge of lighting, electrical engineering, neural networks, etc. will be a plus. He/she must know how to use digital tools for system modeling and/or virtual reality.

He/she must be open-minded and will be able to approach this multidisciplinary subject. Elementary French understanding is welcome but not compulsory.

### Academic or Industrial Collaborations within the framework of the thesis:

This thesis contributes to an ambitious project with a **transdisciplinary objective**, developed by **LAPLACE** as part of the project submitted to the France 2030-PEPR Sustainable City program. The PhD student will collaborate with:

- the XLIM laboratory in Poitiers
- ENTPE (Ecole Nationale des Travaux Publics) in Lyon
- the CEDINT laboratory of the Polytechnic University of Madrid
- the Catholic University of Louvain, Belgium
- the Institute for Research in Computer Science within the framework of the GIS neOCampus

He/she will also interact strongly with members of the IEEE/FDC Smart Cities Technical Community (LAPLACE will offer him/her membership to IEEE during the period of his/her thesis)

### Doctoral student's environment

During his/her thesis, in addition to the supervision by his/her thesis co-supervisors and interactions with the members of the L&M team and the legal benefits (paid leave, remote working, social security coverage, retirement fund, etc.), the doctoral student will benefit from:

- a work desc in the common room of the PhD students of the L&M group
- a laptop with all the necessary software for the work
- Membership in IEEE and more specifically in Smart Cities
- Coverage of costs for participation in international or national conferences to present one's work
- Coverage of travel expenses related to training actions and/or in the context of collaborations
- Waiving of tuition fees for the University
- A net salary of ~2,000 €/month

### Professional prospects for the doctoral student:

The PhD student trained through this thesis will have the ability to manage the development of industrial projects based on systemic approaches. Probably, having its origin in the Engineering sciences, he/she will implement his/her know-how through this truly "Research and Development" project by aggregating knowledge from other disciplines. This experience will take him to a very high level in the issue of sustainable development, particularly in the optimization of the performance of complex systems. With his/her expertise, he/she will be able to work, either in industry or in the academic world, and in any case he/she will participate in the implementation of new strategies that will be used to establish public policies.

### Presentation of the Research Group

The PhD student will be integrated into the Light and Matter (L&M) research group of LAPLACE, which is a joint research unit (UMR 5213), between the CNRS, the University of Toulouse III and the National Polytechnic Institute of Toulouse.

The Light & Matter research group represents about twenty researchers who work on the production and uses of light. His research themes are centered around the science and technology of light sources and lighting systems, as well as the study of the uses of light and its interactions with the environment and society. The themes of the group are inseparable from the applications. Although these activities are strongly related to applications, they do not neglect the fundamental aspects in the field of materials, energy conversion systems for lighting. In everything we do, L&M takes a holistic approach to the system. The group's strategy is to understand how a complex system works, by studying the behavior of its components and their interactions, with the ultimate goal of optimizing the system according to its application/use. To operate this optimization, the group's researchers call on group's skills in modeling and diagnostics, without neglecting prototyping and large-scale demonstration.