

Half-day Tutorial on
Smart Lighting Technologies for Smart Cities

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Abstract:

During the last decade, SSLs-Solid-State Lighting based on components like LEDs, OLEDs and LDs, challenges conventional technologies. In particular, LED has turned into a game changer beating the conventional technologies in all aspects. It is therefore anticipated that in short term, all of electric lighting will be based on SSLs. Today, SSLs proceed to the projected conclusion: replacing all legacy technologies, this is a major change in the lighting market that is considered as a revolution.

Artificial light absorbs 13-14% of the world's electricity annual production. Today, we are witnessing a transition from the conventional "analogue" lighting technologies towards "digital" lighting. Smart lighting will become the backbone for smart cities and homes. Smart lighting concept leads towards the heart of the "Internet of Things". Further, to serve society as effectively as we could, Industry has coined a new term "human-centric lighting" (HCL) to direct its primary efforts in meeting human needs. The objective is switching to smart human-centric lighting driven by both "efficiency" and "quality of light". But this forecast could be severely affected by the "rebound effect" described by Jevons in mid-19th century. Switching to the SSL2 concept, which consists of sustainable smart lighting systems based on solid-state lighting devices, might be one way to stop that harmful effect. Smart, human-centered lighting that incorporates light quality is driven by "appliance efficiency." This merely suggests that the "Right Light" should be provided by next-generation lighting systems with the best levels of quality and efficiency when and where it is needed.

This half-day tutorial will highlight all the above-mentioned issues and will focus on the future of the lighting systems and their contributions to the sustainable development of smart cities.

After this tutorial the attendees will (1) understand the main ideas behind smart lighting technology, (2) master the principles of radiometry, photometry and the associated physical quantities, (3) understand the principles of operation of solid-state light sources and their advantages/disadvantages compared to legacy technologies, (4) understand the impacts of lighting to energy use and environment and (5) be able to apply circular economy principles to lighting systems.

Tutorial's Contents:

- Smart Lighting Systems principles of operation
- Principles of Radiometry and Photometry
- Solid-State Lighting technologies
- Smart Lighting Life Cycle Assessment and Circular Economies principles

Presenters:



Prof. Georges ZISSIS, PhD, FIEEE, Vice-Dean Faculty of Science and Engineering, Toulouse 3 University, IEEE Smart Cities Technical Community Chair. Born in Athens in 1964, has graduated in 1986 from Physics department of University of Crete in general physics. He got his MSc and PhD in Plasma Science in 1987 and 1990 from Toulouse 3 University (France). He is today full Professor in Toulouse 3 University (France). His primary area of work is in the field of Light Systems Science and Technology. He is especially interested in the sustainable smart lighting systems; system and metrology issues for solid-state lighting systems; standardization and quality issues for light sources; impact of lighting to energy, environment, quality of life, health and security; illumination and lighting. He is director of "Light & Matter" research group of LAPLACE that enrolls 20 researchers. He won in December 2006 the 1st Award of the International Electrotechnical Committee (IEC) Centenary Challenge for his work on mesopic vision

standardization for urban lighting systems (in conjunction with IEEE, IET and the Observer). In 2009, he won the Energy Globe Award for France and in 2022 he got the Alfred Monnier Award which is the highest recognition from the French Illuminating Engineering Society. He was Vice-Rector of Toulouse 3 University delegated to International Cooperation (2019-23). He was President IEEE Industrial Application Society (2019-20), and President of the Power Electronics, Electronics, Optoelectronics and System section of the French National Council of Universities (2014-19). He initiated and he chairs the IEEE Smart Lighting Initiative under IEEE Future Directions umbrella.



Dr. Laurent CANALE, PhD, Research Engineer, SMIEEE. Born in Saint-Martin d'Hères (France) in 1972, he holds a master's degree and a doctorate in high frequency electronics and optoelectronics from the University of Limoges, France, obtained in 1998 and 2002. He published on highly magnetic thin films but his main area of interest was pulsed laser deposition of thin films of lithium niobate used for optical telecommunications. From 2004 to 2010, he worked as a research engineer at the National Institute of Agronomic Research at the BioEMCo laboratory (Paris, France). In 2010, he joined the National Center for Scientific Research (CNRS) and worked at LAPLACE Lab., in the "Light & Matter" research group, focused on efficient light sources such as LEDs and OLEDs. He has published more than 200 scientific communications. He has participated in the French Lighting Association as President of the Midi-Pyrénées region since 2014 and he has been President of the IEEE "Industry Lighting and Display Committee" (IEEE IAS ILDC) since 2023. In 2024, we awarded the Fresnel Medal from the French Illuminating Engineering Society.