UNIVERSITATEA TEHNICĂ ”GHEORGHE ASACHI”
DIN IAȘI
FACULTATEA DE INGINERIE ELECTRICĂ,
ENERGETICĂ ȘI INFORMATICĂ APLICATĂ

# HABILITATION THESIS

**ABSTRACT**

# LIGHTING ENGINEERING,

# IN THE TRUE LIGHT

Domain: ELECTRICAL ENGINEERING

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The author has five main research directions, after which the Habilitation Thesis is structured, respectively the following:

**1. Modeling and calculation of lighting systems**

a. Even if there are very strong specialized programs, the classical theory of lighting calculation still admits improvements, by generalizing the calculation of the illumination of some surfaces, the calculation of multiple reflections between surfaces of any shapes.

b. The calculation of lighting systems for tunnels, due to the poor development of the respective infrastructure in Romania, poses special calculation problems, which are not accessible to general calculation programs.

c. The design of lighting systems for the elderly is another direction in which the traditional calculation is not comprehensive, the author demonstrating that a design is necessary not according to the lighting level, but according to the luminance contrast.

**2. Imaging luminance measurement and the fight against light pollution**

a. The calibration of digital cameras for luminance measurement is a valuable achievement, based on which the author has won three specialized grants and has managed to address many research topics.

b. Measuring luminance and especially the luminance field is a high-impact research method, because usually, in lighting engineering, this quantity is neither calculated nor measured. The creation of luminance maps of building facades allowed the author to "discover" the world, and especially to discover light pollution.

c. The imaging measurement of luminance allowed the author to highlight not only the presence of light pollution, to which the eye is not sensitive, but also allowed him to identify the source of this pollution, through case studies.

d. Field measurement of luminance contrast is very useful for estimating the visibility of real scenes, both for the normal observer but also for elderly or afflicted observers. The method has the potential to be applied to many other problems related to visibility, from road markings to various signs, in clear weather or fog, etc.

e. Designing architectural lighting according to luminance contrast, with the involvement of embedded microsystems and the possibilities offered by IoT, is another valuable research direction, as it adds energy saving as a strategic priority.

**3. Study of the thermal regime of electrical devices**

a. The studied device is the photovoltaic panel, operating in a tropical environment, but the study methodology has applicability with potential for capitalization in two research contracts in which the author is a member, running from 2020 to 2022. The first contract is about optimization thermal regime of photovoltaic panels, by forced cooling. The second contract has as its theme a hybrid modular solar system for heating buildings with simultaneous production of electricity with photovoltaic panels and production and hot water consumption. This contract also runs from 2020 to 2022.

b. The second research direction, currently carried out, is the study of the thermal regime of an integrating sphere. This sphere is made by 3D printing, and has a characteristic honeycomb structure. The material used is very sensitive to temperature and therefore the maximum permissible clearances of the lighting sources must be studied, for which the permissible temperature limit is not reached.

**4. Colorimetry - Measurement of color temperature and quality of light sources**

a. Imaging measurements can be used to characterize light sources, whose parameters can depreciate over time.

b. Imaging measurement of color temperature is a much more affordable method compared to using a spectrometer.

c. Embedded microsystems are another direction of research, which underlie a portable system capable of analyzing the exposure of subjects to various light environments, possibly harmful.

**5. Imaging measurements for public lighting**

a. The street lighting is in full refurbishment, by implementing LED sources. The redesign of street lighting makes the interest for this subject to be major, with many particular aspects, such as visibility in intersections.

b. Imaging measurements are applicable in the quantitative assessment of areas where visibility is a priority on which road traffic safety depends, as is the case with road tunnels.

c. Predictive maintenance, so important in many technical areas, has no technical support for street lighting, although the long life of LEDs would justify these interventions. The author's method for measuring high luminances of LEDs allows tracking the degradation of parameters over time and finding strategies for predictive maintenance.

d. The connection of the public lighting according to the obligatory minimum visibility, which depends on the road class, is another research direction with a high degree of originality, in which the analysis of the luminance contrast is capitalized.

e. Analyzing the luminance field that requires a driver's vision while driving at night is another area of research. A maximum success would be the implementation of the experimental stand made as an additional safety system on board vehicles, but also in a more modest version, results will be obtained in the form of monitoring the aggressive lighting environment of cities.