

Contribution of Serbia and Montenegro national team:

- PROJECT 1: "Lighting Quality as a Basis for Energy Efficient Lighting Design"
- LEADER: Dr Lidija Djokic, dipl.ing.arch.
- PROJECT 2: "Energy Saving Potential as a Result of Illuminance Level Control"
- LEADER: Prof. Dr Miomir Kostic, dipl.ing.el.

References relevant for the projects:

Papers published in renown international journals

1. **M.Kostic** and N.Radovanovic, "Calculation of the Indirect Component of the Horizontal Illuminance", *Lighting Res. and Tech.*, vol. 26, pp.107-113, 1994.
2. **M.B.Kostic** and F.V.Topalis, "Interior Lighting Calculations: Survey of Theoretical Methods", *Lighting Res. and Tech.*, vol.30, pp.151-157, 1998.
3. F.V.Topalis, **M.B.Kostic** and Z.R.Radakovic, "Advantages and Disadvantages of the Use of Compact Fluorescent Lamps with Electronic Control Gear", *Lighting Res. and Tech.*, vol.34, pp.279-288, 2002.
4. F.V.Topalis, **M.B.Kostic** and Z.R.Radakovic, "The Voltage Distortion in Low Voltage Networks Caused by Compact Fluorescent Lamps with Electronic Gear", accepted for publication in *Electric Power System Research*.

References relevant for the project:

Papers presented at renown international conferences

1. I.F.Gonos , **M.B.Kostic** and F.V.Topalis, "Harmonic Distortion in Electric Power Systems Introduced by Compact Fluorescent Lamps", IEEE Budapest Power Tech '99 Conference, 1999.
2. F.V.Topalis, I.F.Gonos and **M.B.Kostic**, "Effects of Changing Line Voltage on the Harmonic Current of Compact Fluorescent Lamps", International Conference on Power and Energy Systems, Las Vegas / USA, 1999.
3. N.Mpisketzi, G.Polymeropoulos, **M.B.Kostic** and F.V. Topalis, "Efficiency of Road Lighting Installations From the Point of View of Mesopic Vision", Proceedings of the 3rd Mediterranean Conference on Power Generation, Transmission and Distribution, Med Power 2002, Athens, Greece, 2002.
4. **L.Djokic** and **M.Kostic**, "A Lighting Design Protocol", 25th CIE Session in San Diego, 2003.

References relevant for the project: Papers presented at renown international conferences

5. **L. Djokic**, “Human Needs as Base for Lighting Design”, International Conference: Architecture – Urbanism At The Turn Of The III Millennium, Conference Proceedings, vol. 2, pp. 203-207, Belgrade, Yugoslavia, 1996.
6. **L. Djokic**, “Quality Lighting as a Measure for Violence Reduction”, International Workshop on Disasters: Cities and Buildings, Centre for Built Environment, Calcutta, India, 1998.

References relevant for the project:

Books and Publications

1. **M.B.Kostic**, “Application of the Method of subareas and the Point – matching method in designs of foundation grounding system and interior lighting”, Department of Electrical Engineering, University of Belgrade, 1999.
2. **M.B.Kostic**, “Lighting Guide”, Minel-Schreder, Belgrade, 2000.
3. **M.B.Kostic**, “Theory and practice of electrical installations design”, Akademska misao, Belgrade, 2002.
4. **L. Djokic**, “Light as a Theme in Design: The Teaching Library at the University of Southern California”, Master’s thesis, University of Southern California, Los Angeles, USA, 1991.
5. **L. Djokic**, “Criteria for a Lighting Design Protocol”, Doctoral dissertation, University of Belgrade, 2001.

References relevant for the project:

Projects

1. **M.B.Kostic** and F.V. Topalis, "Development of an algorithm for interior lighting design, based on the modern Zonal-Cavity Method", Programme of scientific and technical cooperation between Greece and Yugoslavia, 1997.
2. **M.B.Kostic**, F.V. Topalis and Z.R.Radakovic, "Experimental investigation of electrical and photometric properties of electronic compact fluorescent lamps and the determination of the influence of their extensive use on the reduction of energy consumption, as well as on the voltage distortion of electric networks of Greece and Yugoslavia", Programme of scientific and technical cooperation between Greece and Yugoslavia, 2000.

References relevant for the project: Studies

1. **M.B.Kostic, L.S.Djokic** and N.A.Hadziefendic, "Determination of the Group Lamp Replacement Period and Maintenance Factor in Road Lighting" (Financed by Belgrade Power Utility), 2003.
2. **M.B.Kostic, L.S.Djokic, N.A.Hadziefendic** and N. Strbac-Hadzibegovic, "Technical and Economic Comparison: Master vs. Conventional HPS Lamps in Road Lighting" (Financed by Belgrade Power Utility), 2004.
3. **M.B.Kostic, L.S.Djokic, N.A.Hadziefendic** and Z.Vilus, "Technical and Economic Analysis of the Use of Philips Starsense System for Continual Light Control in Road Lighting" (Financed by Belgrade Power Utility), 2004.
4. **M.B.Kostic, L.S.Djokic, N.A.Hadziefendic** and Z.Markovic, "Technical and Economic Comparison: Low Poles vs. High Poles in Highway Lighting" (Financed by Belgrade Power Utility), 2004.

References relevant for the project: Study

1. **M. Kostic, L. Djokic, N. Strbac-Hadzibegovic and D. Pojatar**, “Influence of the Lamp Spectral Power Distribution on Visual Conditions in Road Lighting: Techno-Economic Analysis” (Financed by Philips Lighting), in progress.



References relevant for the project: Lighting Software

1. **M.B. Kostic** and S. Stanojevic, “Lighting Star ’96”, Software for interior lighting design, based on Zonal Cavity Method, 1996.

- PROJECT 1: "Lighting Quality as a Basis for Energy Efficient Lighting Design"
- LEADER: Dr Lidija Djokic ,dipl.ing.arch.

The first necessary step in the process of lighting design assumes determination of the requests that condition specific effects. Possible requests (conditions) relevant for lighting quality (gained through literature and experience) can be defined as:

- User requests,
- Space conditions, and
- Requests made by objects and surfaces that are being lit.



- All of these requests (conditions) can be grouped into several aspects, or categories, that influence the quality of lighting in different ways.

- The next step will be to determine the specific lighting quality factors (parameters) which depend on the defined requests (conditions), describing the quality of lighting.

The lighting quality factors, which relate to the given requests (conditions), should incorporate:

- lighting system,
- type of lighting,
- direction of light and shadows,
- color of light,
- illuminance level and uniformity,
- luminance distribution,
- glare limitation.

- For each aspect, the relationship between the specific requests (conditions) and the relevant quality factors (with the appropriate recommendations) will be offered in a form of a table, so that the wanted information can be easily reached.

QUALITY FACTORS CONDITIONS		LIGHTING SYSTEM	TYPE OF LIGHTING	DIRECTION OF LIGHT AND SHADOWS	COLOR OF LIGHT
					
BIOLOGICAL ASPECT SPACES OCCUPIED BY THE ELDERLY . .		A combination of general and local lighting where local lighting clearly stresses the objects of interest and general lighting enables easy adaptation and accommodation.	Spot light sources to stress the objects of interest and linear or planar for general lighting (due to necessity to restrict glare).	Direct or indirect lighting. Light source must not interfere with visual field of the users.	Warm color sources with very good color rendering for pleasant and warm atmosphere and best possible comprehension of interior.
PHYSICAL ASPECT . . SMALL OBJECTS IN COMPARISON WITH THE SPACE IN WHICH THEY ARE SET . .		Local lighting.	Spot lighting.	Direct lighting if the object should attract attention.	Color of light depends on surface quality (color, material, finish).
FUNCTIONAL ASPECT . . . LIBRARY BOOK STACKS . .		Localized lighting.	Planar or linear lighting.	Indirect lighting with a specially designed luminaire surface which reflects light towards the books, or possibly, direct lighting with a diffuser and UV-stop lamps.	

This approach facilitates the lighting design process by introducing a protocol, which consists of:

- A selection of the offered requests (conditions) relevant for the space under consideration,
- A comparison of the offered possibilities and restrictions for each of the quality factors to which the selected requests (conditions) apply, and
- A determination of a code (resulting quality factors) formed on the basis of the recommendations that satisfy most of the selected requests (conditions).

- PROJECT 2: "Energy Saving Potential as a Result of Illuminance Level Control"

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- The aim of the second project is to determine an algorithm which will enable an almost constant (maintained) illuminance level through the whole maintenance period by using devices for continual lamp luminous flux regulation.
- In this way, illuminance levels higher than requested are avoided during exploitation and considerable energy savings can be achieved.

- In order to determine an algorithm with quantitative values of the lamp luminous flux reduction through the maintenance period, a collection of lamp lumen and luminaire maintenance curves is necessary for relevant types of lamps and luminaires. This data will determine how often the lamp luminous flux should be reduced (period), as well as the percentage of each reduction.

- The final goal is to evaluate the possible energy savings, provided by the application of the determined algorithm.
- Note that a similar project regarding road lighting (done by our national team) showed that energy savings accomplished in this way amounted to around 6%.