

SYSTEMATIC AND METHODICAL APPROACHES TO LIGHTING DESIGN. "SATI" SYSTEM

МЕТОДИЧНИ ПОДХОДИ НА СИСТЕМНИЯ СВЕТЛИНЕН ДИЗАЙН. СИСТЕМА "SATI"

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Abstract: The report represents the fundamentals of SATI System.

KEYWORDS: SYSTEMATIC AND METHODICAL APPROACHES, SUSTAINABLE LIGHTING, LIGHTING DESIGN, SATI SYSTEM.

Introduction

Historically, at the very first steps, the electric lighting systems was realized through analysis, synthesis and evaluation of individual items without applying any systematic approach, without taking into account the principles and laws of the "man-machine-environment" system, but only simply focused on the methods of technical sciences, hence machine-centric approach. At a later stage the human factor took a larger role in the design of lighting systems, as it provided the opportunity to explore specific problems with the light climate and the processes that occurred in the human perception towards visual information. Therefore, thanks to the anthropocentric approach, today the contemporary lighting systems have acquired other dimensions, as the operator is not treated as a simple unit but rather as a highly organized subsystem with essential and specific functions.

There has been noticed that the lighting system should be considered as a complex system "man-machine-environment" built by a number of subsystems.

1. Structure of the "SATI" system - Ist level

The methodological lighting design system "SATI" (System Approach Towards Illumination) includes twelve major approaches which covers the main issues when building sustainable lighting systems.

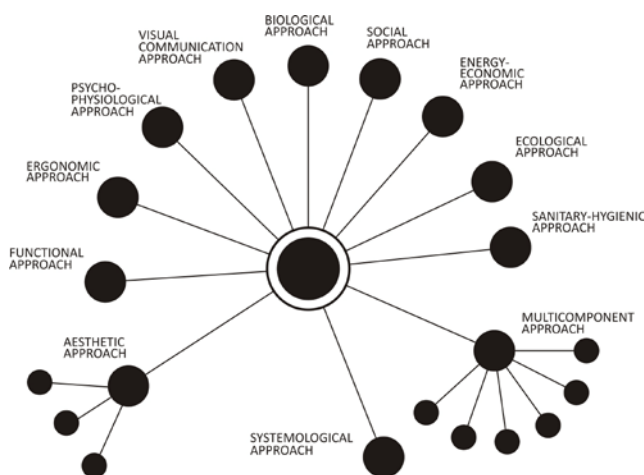


Fig. 1. Structure of the SATI system

1. Aesthetic approach

The Aesthetic approach represents three main groups: 1. Compositional criterion. 2. Lighting criterion. 3. Color criterion.

Compositional criterion refers to the composition development in lighting design, focusing on the major categories, and properties - their interaction with light environment.

Lighting criterion examines the relationship between the lighting design and the various types of lighting sources, the behavior of light in space and evaluation of the light climate by qualitative and quantitative indicators.

The colour criterion plays a critical role in the design process towards the lighting environment.

In general the Aesthetic approach provides a that works to thorough determined insight and concrete focus to direct aesthetic "tools" necessary for the realization of lighting systems with leading

In general plan Aesthetic approach is focused on the basic aesthetic "tools", which are essential for the development of complex lighting system with a distinctively decorative character (decorative application).

2. Functional Approach

The Functional approach examines the variety of lighting systems in terms of their practical use. Two main groups are defined here - functional and decorative lighting. Despite the strong distinction between the both types of lighting application, there has been found a third one that refers to both types of application with a different "weight" of the functional and decorative element. There also have been pointed out some aspects of the pure functional nature of lighting systems and the way they work towards several specific visual task.

3. Ergonomic approach

The Ergonomic approach focuses on the objectively necessary requirements and constraints which influence the design of the lighting systems including the normal functioning of the eye and the direct impact of light on it (types of glare, visual dysfunctions, direct exposure to strong light) the general human condition, taking into account the peculiarities of the climate, latitude, seasons and others.

4. Psycho-physiological approach

The Psycho-physiological approach reveals the influence of lighting systems on the activity of the human body. The approach takes on focus the various characteristics of visual functions, the visual perception of shapes, color and light.

5. Visual communication approach

The Visual communication approach examines the visual information transfer which concerns the elements of visual communication process, the distribution of information relating to the human receptors, the characteristics of visual information and others. In addition, there is a focus on the physiological characteristics in visual perception and specific factors that affects the human interaction with light environment.

6. Biological approach

The Biological approach takes direct role of the light design with regard to natural and healthy development of biological objects (people, animals, plants). With particular relevance in this section is concerned the impact of artificial light sources in terms of their radiation spectrum.

7. Social approach

The Social approach plays an important role in the adaptation of the light climate to the visual necessity of the different social groups distinguished by gender and age. The social approach is essential for the development of the advanced lighting systems and it dramatically changes the quality of light when the main parameters are synchronized the values specified in the Bulgarian standards (Bulgarian Institute for Standardization).

8. Energy-economic approach

The Energy-economic approach examines in detail the possibilities for optimal energy management of functional and decorative lighting towards the use of light sources, luminaires and lighting systems.

9. Ecological approach

The Ecological approach provides a detailed overview of the possible types of lighting pollution and especially the impact of the artificial light. In this regard, the use of modern energy sources leads to the use of a small amount of energy generated by power plants and thus it reduces the greenhouse effect globally.

10. Sanitary-hygienic approach

The Sanitary-hygienic approach outlines the basic requirements that must be observed when using artificial lighting. Ensuring healthy and safe working conditions and rest is a matter of the rational design quantitative and qualitative indicators, light modeling (adequate amount of light, biodynamic lighting planning) which are dependent to the specific conditions of the light environment in certain geographical areas.

11. Multicomponent approach

The Multicomponent approach reveals the complex nature of the lighting systems – a network of individual lighting elements which have different functional application to build up certain lighting environment in specific fields like Architectural lighting, Road and Street Lighting, Advertising and Information lighting, Automotive Lighting and Interior lighting.

12. Systemological approach

The Systemological approach reveals the boundless horizons of conceptual solutions in modern lighting design. The knowledge of systems' types and behaviors namely linear and nonlinear, open and closed (and the possible combinations between them) provokes and encourages the innovative and creative thinking. The Automotive Lighting Sculpture is a clear example of that philosophy (ALS concept). The Systemological approach is an open window to novelty and beauty, to the future.

2. Structure of "SATI" system - IInd level

The SATI system includes subsystems ("Extended Block of the Systematic Lighting Design") including twelve fundamental approaches (needed for building sustainable lighting systems) with a definitive autonomy and with a direct interaction in the lighting network. Each subsystem has an individual conceptual focus, structure and properties. The subsystems are built up of elements, called "factors" that make up the uniqueness of each approach. The information of each factor is organized by a number of criteria that determine the systematic nature of the whole block system.



Fig. 2. Structure of "SATI" system. Extended Block of the Systematic Lighting Design

Table 1. Number of the SATI system elements

Approach	Number of elements
Aesthetic approach	38
Functional approach	7
Ergonomic approach	8
Psycho-physiological approach	6
Visual communication approach	7
Biological approach	3
Social approach	2
Energy-economic Approach	4
Ecological approach	2
Sanitary-hygienic approach	4
Multicomponent approach	33
Systemological approach	7

3. Focus of the "SATI" System

Modern urban area includes a wide variety of lighting solutions with specific lighting behavior (specific application). The focus of the "SATI" System concerns five fields of lighting design – Architectural Lighting, Road and Street Lighting, Commercial and Information lighting, Automotive Lighting and Interior Lighting. Their choice has been motivated primarily by the specificity of their application - functional, decorative and functional-decorative purpose.

1. Architectural lighting

The Architectural lighting is a leading field in the lighting design with definitive decorative application creating a spectacular night picture in which the city sights (with cultural, historical and social significance) are harmoniously assembled with the beautiful nature by appropriate lighting design.

2. Road and Street Lighting

The Road and Street lighting is functional outdoor lighting that mainly provide visual comfort of the participants on the road but also it is factor that efficiently influences the decrease the criminal activities and accidents.

3. Commercial and Information lighting

The Commercial and information lighting design is a field that includes solutions with complex nature depending on the specific task they perform – there are either lighting solutions with pure functional or decorative application, or such which have both functional and decorative features in their layout. The main objective of the this group is to present certain information in the most attractive and accessible to the audience way to promote and facilitate public awareness and communication.

4. Interior lighting

The Interior lighting also has a dual nature as the leading task it faces is to achieve adequate light climate, according to the use of the premises.

5. Automotive lighting

The Automotive lighting has changed significantly due to the rapid development of the lighting industry. Today there are many good examples of advanced lighting systems with leading functional application (that meets the main visual tasks) and decorative features depending on the brand identity they follow.

Conclusion

There has been developed a methodological model (SATI - System Approach Towards Illumination) represented by the "Extended Block of the Systematic Lighting Design", which has the main role to identify and satisfy the needs of certain lighting environment with specific nature of application. The extended block includes a set of twelve approaches as they follow - Aesthetic approach, Functional approach, Ergonomic approach, Psycho-physiological approach, Visual communication approach, Biological approach, Social approach, Energy-economic approach, Ecological approach, Sanitary-hygienic approach, Multicomponent approach and Systemological approach.

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