

VISUALIZATION IN ELECTRICAL POWER ENGINEERING

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ABSTRACT

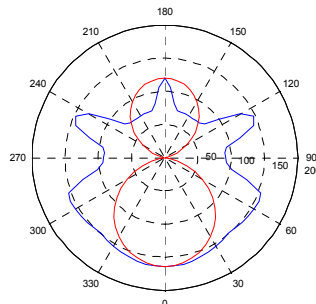
This article describes one of possible visualization of data in electrical power engineering. The article mainly pay attention to the luminous intensity curve of luminaries which represents vector of luminous. It is possible to calculate efficiency from these luminous intensity curves due to methods of zonal light flux. The article also indicate how the data about luminaires are stored in the EULUMDAT format from which the data are then used for visualization.

1. INTRODUCTION

On the present we try to save energy but it is necessary to save electrical energy. Part of the consumption of electricity is consumed in converting to artificial light. Annually all over the world we consume more than 2 600 TW·h of electricity to convert to lighting, which is about 19% of total electricity consumption in the world [1]. Therefore it is necessary to design illuminating system efficiently and without unnecessary demands of energy consumption. One of the steps of doing this is to correct choice of luminaire with optimal luminous intensity curve. This curve describes the vector of luminous intensity.

2. ANALYSIS

Graphic display of luminous intensity curves is often depicted in polar coordinates for the half plane C0-C180 and C90-C270 [2]. This view *Figure 1*, but often misinterprets representative about the shape of the luminous intensity curve. Therefore, good data visualization is great tool in the design illuminating systems.



Obrázek 1: Example of luminous intensity curves

2.1. DATA FORMAT

Most often the data of luminous intensity are stored in a file EULUMDAT format. It is basically a text file where each of line represents some information about luminaries.

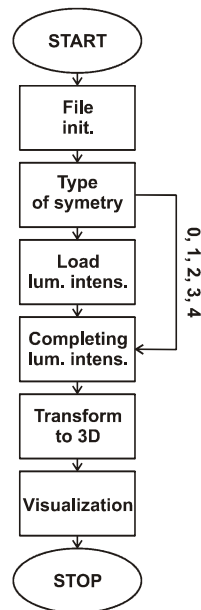
Item	Designation
1	Company identification/data bank/version/format identification max.
2	Type indicator I _{typ}
3	Symmetry indicator I _{sym}
4	Number M _c of C-planes between 0 and 360 degrees (usually 24 for interior, 36 for road lighting luminaires)
5	Distance D _c between C-planes (D _c = 0 for non-equidistantly available C-planes)
6	Number N _g of luminous intensities in each C-plane (usually 19 or 37)
7	Distance D _g between luminous intensities per C-plane (D _g = 0 for non-equidistantly available luminous intensities in C-planes)
8	Measurement report number
9	Luminaire name
10	Luminaire number
11	File name
12	Date/user
13	Length/diameter of luminaire (mm)
14	Width of luminaire b (mm) (b = 0 for circular luminaire)
15	Height of luminaire (mm)
16	Length/diameter of luminous area (mm)
17	Width of luminous area b _l (mm) (b _l = 0 for circular luminous area of luminaire)
18	Height of luminous area C0-plane (mm)
19	Height of luminous area C90-plane (mm)
20	Height of luminous area C180-plane (mm)
21	Height of luminous area C270-plane (mm)
22	Downward flux fraction DFF (%)
23	Light output ratio luminaire LORL (%)
24	Conversion factor for luminous intensities (depending on measurement)
25	Tilt of luminaire during measurement (road lighting luminaires)
26	Number n of standard sets of lamps (optional, also extendable on company-specific basis)
26a	Number of lamps
26b	Type of lamps
26c	Total luminous flux of lamps (lumens)
26d	Color appearance / color temperature of lamps
26e	Color rendering group / color rendering index
26f	Wattage including ballast (watts)
27	Direct ratios DR for room indices k = 0.6 ... 5 (for determination of luminaire numbers according to utilization factor method)
28	Angles C (beginning with 0 degrees)
29	Angles G (beginning with 0 degrees)
30	Luminous intensity distribution (candela / 1000 lumens)

Tabulka 1: Description of lines in the file EULUMDAT

Detailed information is in [3]. This data must be read from a file and prepared for processing.

2.2. PROCESSING

Data processing is performed in MATLAB, where the data is properly processed and converted to display a 3D model. Description of the script source code released by more than 5 pages of text so I will not be addressed.

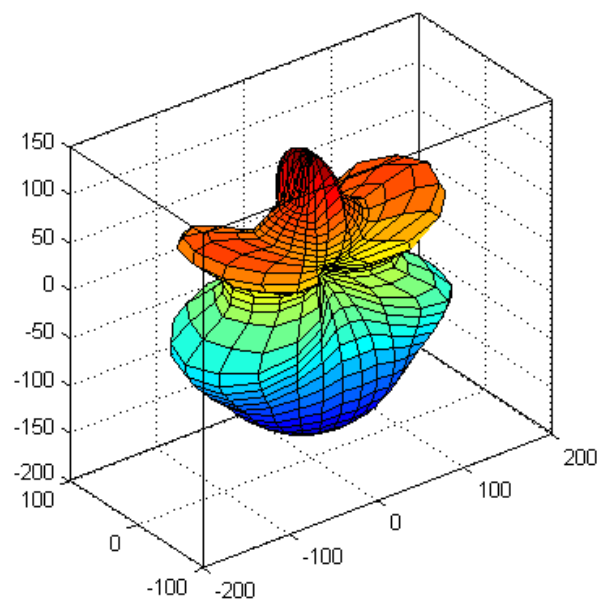


Obrázek 2: Processing block diagram

Data processing is under way according to this algorithm. At first step a data file is initialized. At the second step is found out the type of symmetry of luminaries. At the other step the luminous intensity are loaded luminaries. According to the type of symmetry of luminaries are the data about luminous intensity suitable completed. At the next step the data are transformed to 3D. Finally are the data visualized.

2.3. RESULTS

The result of the whole work is visualization of intensity curve in 3D view *Figure 2*.



Obrázek 3: 3D luminous intensity

3. CONCLUSION

Through comparing of these two images can be seen that the image luminous intensity in 3D is richer than the mere representation of the polar graph. The pictured script can visualize all the luminous intensity curves stored in the EULUMDAT format and contribute to a better designer's idea about luminous intensity curve. This allows the designer to design easily better lighting system, which can be environmentally friendly.

REFERENCES

- [1] KUBEŠ, Karel. Budova osvětlená výhradně diodami LED. Světlo. 2010, 1, s. 33. ISSN 1212-0812
- [2] The IESNA. Lighting Handbook : Reference & Application. Ninth Edition. New York : IESNA, 2000. 600 s. ISBN 0-87995-150-8.
- [3] EULUMDAT File Format Specification [online]. 1999-2009 [cit. 2010-03-01]. EULUMDAT. Dostupné z WWW: <<http://www.helios32.com/Eulumdat.htm>>.