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LED-based product development: a breakthrough in design methodology

Delphi4LED, a consortium with 15 partners from 7 countries bringing together luminaire makers, academia, and software partners

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- Delphi4LED gathers the expertise of European leading organizations dealing with LED integration.
- Delphi4LED is supported by the ECSEL Joint Undertaking - the Public-Private Partnership for Electronic Components and Systems, a funding program of the European Union...
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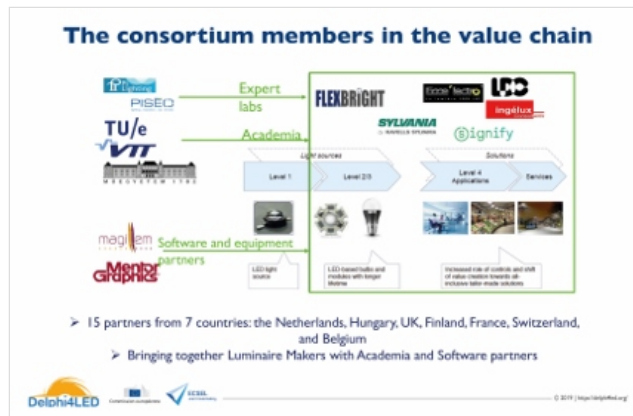
LYON, France – September 11, 2019: The strong competition between LED companies is not a secret to anyone. The number of LED makers, especially the Chinese ones is today really impressive. Looking for innovative lighting solutions with higher performance and lower costs, the companies investigate how to reduce development time and manufacturing costs. Under this dynamic context, the European Consortium, Delphi4LED has found a new way of thinking, a new way to develop efficient lighting solutions, especially for the attractive automotive and general lighting markets. For example, the lighting market for automotive applications is showing impressive revenues to reach about $37.3 billion in 2023 (2) .

Created in 2016, Delphi4LED gathers the expertise of European leading organizations dealing with LED integration, SIGNIFY (PHILIPS) (NL, FR), TU/e (NL), BME (HU), Mentor Graphics (HU, UK) VTT (FI), LDC (FI), FLEXBRIGHT (FI), MAGILLEM (FR), INGELUX (FR), PI LIGHTING (CH), PISEO (FR), ECCE'LECTRO (FR), FEILO-SYLVANIA (HAVELLS) (BE).

Delphi4LED is supported by the ECSEL Joint Undertaking - the Public-Private Partnership for Electronic Components and Systems, a funding program of the European Union, completed with the financial support of the national funding authorities of the participating countries involved in the consortium.

The objective of the Delphi4LED project was to develop a standardized method to create multi-domain (1) LED based design and simulation tools for the solid-state lighting industry from measurements. Delphi4LED consortium is a smart combination of 15 partners from 7 different countries. Luminaire makers, academia, technical centers, software players and lighting designers share their knowledge of the LED technology to propose a valuable solution to the lighting industry. Delphi4LED's partners are part of the overall LED value-chain and offer a high added-value LED knowledge.

"It is the fact that a generic method to extract models, and a vendor neutral file format to support provision, didn't exist until today," asserts **Joël Thomé, Head of PISEO, partner of the Delphi4LED consortium.***"This status strongly motivated the creation of the European Union consortium, Delphi4LED mixing valuable LED*

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expertise in order to achieve a breakthrough in LED-based product design".

By identifying appropriate optical and thermal characterization test procedures, a mathematical formulation of the multi-domain model and an e-datasheet neutral file format, Delphi4LED aims to address design inefficiencies for lighting products that exist today.

At present the system level numerical analysis of integrated LED products is typically performed by the different design teams dealing with the electrical, thermal and optical design separately. Today's reverse engineering technique combined lead to reasonable results but with long development time and waste of money…

It is the time and effort involved in gathering, reverse engineering and extracting the necessary information to be used for simulation of the thermal-optical behaviour of an LED in a given end user environment that leads at best to increased design costs, at worst to simulation not being performed and thus an increased risk of design goals not being met, identified during physical prototyping. It is exactly these risks and inefficiencies that Delphi4LED aims to address.

A multi-domain LED model requires both predictive accuracy as well as the obfuscation of proprietary information regarding the LED package's construction and material properties. Delphi4LED has addressed these model requirements by:

Elaborating a test procedure to determine optical and electrical characteristics at a series of prescribed operating LED chip junction temperatures

Identifying a set of temperature aware optical-electrical functions, the parameters for which are extracted directly from measurement

Identifying a thermal network topology representation and a method to extract its thermal resistances and thermal capacitances

The Delphi4LED partners have conducted lot of investigations and today, results are available that will enable the design and production of more reliable, cost effective and market-leading LED-based lighting solutions in the future. In parallel, standardization activities concerning test methods of LED packages, characteristics presentation, generation of LED models and model interfaces have made strong progress within JEDEC and CIE appropriate committees. An important milestone has been passed in 2019 in these committees towards balloting updates of test standards and their final technical reports.

This will create soon a momentum that will drive a quick adoption of this new design methodology by the whole lighting industry to the benefit of the end user.

About the consortium, Delphi4LED

The partners of the Delphi4LED consortium consists of 15 partners from 7 countries bringing together luminaire makers, academia, and software partners of which the:

- Industry partners are involved in the direct LED value chain and provide knowledge of LED portfolio combined with end-application

- Academic partners provide profound knowledge on compact modelling methodology, measurements techniques and model extraction for LEDs and electronic components in general,

- Software partners develop required software tools and provide knowledge of simulation and integration of multi-domain compact models...

Since most LED manufacturers are Asian based, in order to stay independent from them, the Delphi4LED method is set-up in such a way that no input from them is required. As such, there is no LED manufacturer involved in the consortium.

More on Delphi4LED website.

About ECSEL JU

The "Electronic Components and Systems for European Leadership" (ECSEL) is a Joint Undertaking established in June 2014 by the European Union Council Regulation No 561/2014. It is a public-private partnership that will engage, for 2014 to 2020, up to 1.17 billion euro funding from the European Union's Horizon 2020 research and innovation programme, combining it with a commensurate amount of national/regional funding and participants' own contributions to leverage about 5 billion euro Research and Innovation investments in nanoelectronics, embedded and cyber-physical systems, and system integration technologies. The R&D actors are represented by the associations AENEAS, ARTEMISIA and EPoSS. More info. on www.ecsel.eu/

About PISEO

A unique innovation platform specializing in the design and characterization of illumination, detection and imaging systems, integrating advanced photonic technologies (LED, VCSEL, laser diodes, spectrometers, image sensors, lidar, phosphors, optical materials ...).

PISEO supports companies in all business sectors in their efforts to innovate and improve their operating margins. The company is member of Cluster Lumière association (www.clusterlumiere.com) which has been supporting the Delphi4LED project since the beginning.

More info on www.piseo.fr

Note:

(1) Including Thermal, optical, electrical domains

Source:

(2) Automotive Lighting: Technology, Industry and Market Trends report, Yole Développement, 2018