Prospects of Multiphysics Simulations to Steer the Development of High Brightness LED Technologies

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Abstract

The versatility of COMSOL Multiphysics® software has positioned it at competitive levels against other considered industrial-standard engineering software tools. This contribution is directed towards emphasizing the need of further developing the basic concepts of this versatile tool in order to enable the implementation of complex physics modeling techniques in rapid, flexible and customized ways. It is through this process that one can create optimized models tailored specifically to fulfill design needs. The exploitation of many of COMSOL's intrinsic features can be used to successfully implement fast and accurate customized nonlinear multiphysics models that, through standard straight-forward methods offered by many industrial software packages, would have been otherwise inviable. We clearly illustrate the necessity for such customization by describing the complex interaction of multiphysics governing the performance of high brightness emitters. Only through proper physics interpretations, modeling assumptions and dedicated mathematical and numerical implementation techniques it is possible to develop working models suitable for guiding the development of our LED technologies.

Furthermore, some of the insights we provide point out the relevance of the COMSOL LiveLink™ for SOLIDWORKS® to standardize CAD models and exploit them for multiple purposes: Prototyping, ray tracing, thermo-mechanical modeling, etc… We however identify some limitations of its use regarding geometry parameterization of large SOLIDWORKS® software assemblies as well as the implementation of modular and scalable models. Along these lines we also emphasize the importance of the introduction of recent add-ons such as the Ray Optics Module.

The consolidation of this tool as integral part of COMSOL along with the RF, Heat Transfer, AC/DC, and Optimization Modules, along with the LiveLink™ add-ons may allow us to compactly combine most of our engineering tools we use today in just one package.

Reference

1. T. López and T. Margalith, Electro-Thermal Modelling of High Power Light Emitting Diodes Based on Experimental Device Characterisation, Proceedings of the COMSOL Conference 2008 Boston, https://www.comsol.de/paper/download/36660/Lopez.pdf

Figures used in the abstract

Figure 1

Figure 2

Figure 3

Figure 4