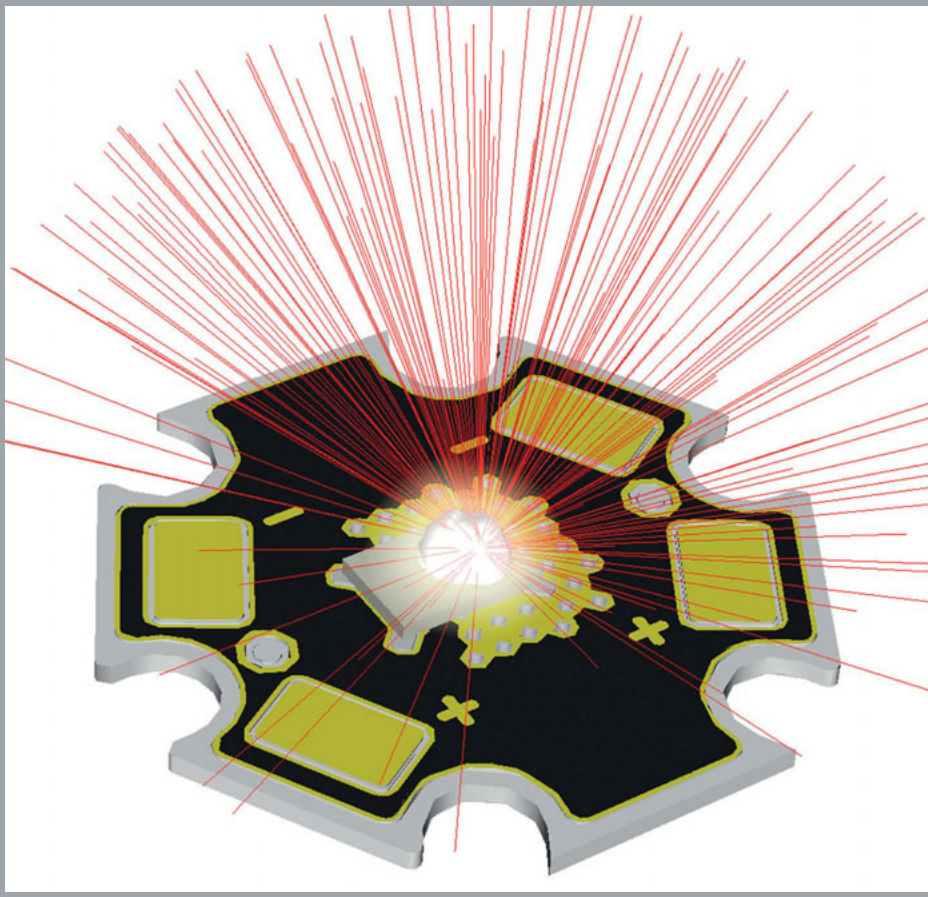
Steinbeis Transfer Center
Applied Lighting Technology

International Light Simulation Symposium 2012

ILISIS 2012

7th/8th of March 2012; Nuremberg, Germany



Proceedings

Steinbeis-Edition

International Light Simulation Symposium 2012

ILISIS 2012

7th/8th of March 2012; Nuremberg, Germany

Proceedings

Steinbeis Transfer Center
Applied Lighting Technology

Imprint

© 2012 Steinbeis-Edition

All rights reserved. No part of this book may be reprinted, reproduced, or utilised in any form by any electronic, mechanical, or other means now known or hereafter invented, including photocopying, microfilming, and recording or in any information storage or retrieval system without written permission from the publisher.

Steinbeis Transfer Center Applied Lighting Technology (Editor)

International Light Simulation Symposium 2012
ILISIS 2012
7th / 8th of March 2012; Nuremberg, Germany
Proceedings

1st edition 2012 | Steinbeis-Edition, Stuttgart

Layout: Steinbeis-Edition
Production: Frick Kreativbüro & Onlinedruckerei e.K., Krumbach

Steinbeis is an international service provider in knowledge and technology transfer. The Steinbeis Transfer Network is made up of about 800 Steinbeis Enterprises and project partners in 50 countries. Specialized in chosen areas, Steinbeis Enterprises' portfolio of services covers consulting; research and development; training and employee development as well as evaluation and expert reports for every sector of technology and management. Steinbeis Enterprises are frequently attached to research establishments, universities, universities of applied sciences and universities of cooperative education.

Founded in 1971, the Steinbeis-Stiftung is the umbrella organization of the Steinbeis Transfer Network. It is headquartered in Stuttgart, Germany. Steinbeis-Edition publishes selected works mirroring the scope of the Steinbeis Network expertise.

138371-2012-03 | www.steinbeis-edition.de

Table of Content

Speakers' Contributions

Rayfiles for non-sequential raytracing 11

Advanced light source with rays for rendering engines 25

Colour Converters: optical elements in Solid State Lighting 43

Thermo optical simulations of white LEDs 53

Realistic Ray-Tracing of Surface and Volume Diffusers 55

Simulation of Phosphor Converted LED Packaging
with Considerations on Phosphor Settling 71

Differential optics for illumination design in the presence of caustics 87

Tolerancing Free Form Optics for Illumination 103

Freeform Surface Calculation for Artificial Lighting and Daylighting 117

Concepts for Shaping Light 131

Modeling of refractive freeform surfaces by a nonlinear PDE
for the generation of a given target light distribution 143

Light-matter interaction at different length scales:
An all-embracing simulation procedure 157

End-to-end Simulation of an LED-edge-lit Liquid Crystal Display 165

Systems Modeling of Vehicular Cameras 179

Stray Light Analysis of Multi-Spectral Optical Filters 199

Specular BSDF Approximation for Efficient Specular Scene Rendering 217

Interior Illumination Simulation in Aircraft Industry 233

Signal Lamp Luminance Distribution Simulation and Assessment Using the ”Volkswagen Benchmark System“.....243

LED Headlamp Distribution Optimization using a Multiple-IES-File-Source Approach.....261

Optical Design process at Valeo Lighting 275

Using a night time driving simulation for the development of camera controlled light algorithms 287

GPU accelerated lighting simulation with LucidShape.....299

Forward Reflection of Road Surfaces for Vehicle Lighting 309

Poster Contributions

Advanced Modeling for Light Simulation....329

Modellierung von Spektren weißer Leuchtdioden....339

Simulation of tightly focused ultrashort optical pulses taking into account polarization 355

Thermal Simulation of Lighting Systems with Open Source Software....371

Theory and practice in plastic optics 385

Principles of Daylight Guiding Design....391

Numerically-based development and construction of a panel light 405

Phase space concepts for illumination systems in optical lithography....421

Signal lamps with diffusive optical parts 429

Development of an optimized LED-CHMSL 439

From Development to Start of Production 447

Virtual development of intelligent headlight systems 463

Processing of Thermoplastic Optics by Compression Induced Solidification 483

Speakers' Contributions

Rayfiles for non-sequential raytracing

Regina Dürr, OSRAM Opto Semiconductors GmbH, Regensburg
Dr. Ulrich Streppel, OSRAM Opto Semiconductors GmbH, Regensburg

Abstract

Rayfiles are a common option to model the nearfield and farfield properties of light sources in optical design software. Especially for the design of secondary optics for LEDs, rayfiles are a useful tool to describe the emission characteristics without modelling the inner details of the light source. Most non-sequential raytracing programs offer an interface for rayfiles. Unfortunately there is no standardized rayfile format today, but a huge variety of incompatible formats encoding almost the same information. In this paper we discuss and compare different rayfile formats. We suggest a new generalized rayfile format which allows flexible and unambiguous storage of ray data. The new format has the capability to serve as a new standard ray data format.

1 What are rayfiles and which information do they contain?

In most optical designs the exact representation of light sources plays an important role. For the design of optical elements close to the light source, optical designers need detailed information about the near field emission characteristics. In such cases, farfield emission data only is not sufficient.

One possibility for light source modelling, and LED modelling in particular, are so-called rayfiles. Rayfiles represent the emission of the light source, e.g. an LED, by a number of rays. Shown in the rayfile are a few thousand up to several million rays exiting the light source. Each ray is described at least by three coordinates defining its start point, three coordinates specifying the propagation direction and the ray power: (x, y, z, l, m, n, ϕ). Rayfiles offer a possibility to describe the near-field and