Abstract — The quick development of the LED has changed the overall field of lighting technology triggering the need for updating all sorts of documents and literature in the field of lighting. The German lighting association LiTG has initiated a project to work on a new, completely revised version of the book "Beleuchtungstechnik" by Roland Baer. This new 4th edition of the book was published in September 2016 and forms the result of the collaborative authorship of more than 20 individuals who are actively involved in lighting education. The book addresses the needs of lighting designers, educators and students from various fields of application. It serves as a source of information for the daily practice as well as study material to support efforts of students in Bachelor and Master programs.

Index Terms — Daylighting, Education, Electric Lighting, Fundamentals, Lighting Control

I. INTRODUCTION

The German Lighting Organization "Deutsche Lichttechnische Gesellschaft e.V." (LiTG) initiated a working group of lighting educators in 2010. During their meeting at the Conference “Licht 2014” in Den Haag, NL, this group discussed a work item to contribute towards a new edition of the German book “Beleuchtungstechnik” (illumination technology). Back then, the third edition of the book had been sold out but the market still saw a huge need for it. “Beleuchtungstechnik” was initially published in 1990 by the authors Roland Baer, Dr.-Ing. Martin Eckert, Dr. sc. techn. Dietrich Gall and Reinhard Schnor.

The book led to a constant stream of sales throughout the various editions. This book is suitable for students who study lighting as well as professionals as a reference for their everyday work.

After the third edition was published in 2006, solid state lighting technology got introduced into the market and took off rapidly. It was clear to the LiTG working group that this disruptive technology change in the field of lighting needed to be reflected in a new edition. It became obvious that the 4th edition of this book would require a complete overhaul. The members of the working group got enthusiastic about the idea and initiated discussions with the editor.

More than 20 individuals who are all involved in lighting education have contributed towards the new edition. Among them were authors who provided content but also reviewers to ensure the quality of the outcome. Next to the initial editor Roland Baer, two co-editors were added to the team: Prof. Meike Barfuß and Dirk Seifert. The group set the ambitious target to complete their work so that the finished book could be presented at the next Conference “Licht” in Karlsruhe in September 2016.

II. THE PROCESS AND TEAM

Through active communication and thorough project management, the team of authors all agreed to take on parts of the book. Quite a number of sections required a thorough review which in some cases resulted in completely re-writing chapters and sections. Selected topics were elevated from being covered in a subsection to now having a
dedicated section in the book. In addition, a completely new chapter on exterior lighting has been added to the table of contents.

The authors took on entire chapters or particular sections. To ensure the overall quality, each author as well as additional experts agreed to peer-review other chapters or sections. After the reviewers submitted their comments back to the authors, the authors updated their contributions accordingly. This process is nearly comparable to the standard peer review process applied by ISI journals. The one exception was the fact that the reviewers were known to the authors. This transparency allowed for direct communication between these two groups of people in the interest of accelerating the process to finalize the texts. This transparency is also reflected in the final version of the book – both, the authors and the reviewers of chapters or sections are mentioned.

Despite all efforts of streamlining the process, the set target date for publication remained ambitious. The timelines related to the necessary process of turning a finished manuscript into a printed book were fixed and defined the ultimate deadline for all authors. Subsequently, there were three major deadlines for the team of authors and reviewers:

1. Final draft to be submitted to the editors
2. Peer-review comments to be sent back to the authors
3. Final version to be submitted to the editors

While this is already difficult enough if there is only one author and one reviewer, the challenge increased by the fact that there were about 20 authors, i.e. 20 such processes that had to run and be completed in parallel. If only one of these parallel processes had failed to meet the final deadline, the entire project would have been at risk.

The team responsible for the creation of the new edition consisted of the following authors: Prof. Meike Barfuß, Dr. Hartmut Billy, PD Dr.-Ing. Peter Bodrogi, Dipl.-Ing. Wolfgang Cornelius, Dr.-Ing. Peter Flesch, Dipl.-Ing. Cornelia Fürst, Prof. Dr.-Ing. Roland Greule, Prof. Dr.-Ing. Tran Quoc Khanh, Dr.-Ing. Martin Kirsten, Prof. Arch. Werner Osterhaus, Prof. Dr. med. Dipl.-Ing. Herbert Plischke, Dipl.-Ing. Uwe Rabenstein, Prof. Dr.-Ing. Alexander Rosemann, Prof. Dr. sc. nat. Christoph Schierz, Dipl.-Ing. Hans-Georg Schmidt, Dipl.-Ing. Dirk Seifert, Dipl.-Ing. Stefan Söllner, Dr. Armin Sperling, Dr.-Ing. Cornelia Vandahl and Prof. Dr.-Ing. Stephan Völker.

The team got completed by the following peer-reviewers: Dr. Matthias Hessling, Prof. Dr. Paola Belloni, Prof. Dr.-Ing. Horst Riechert, Dr. Felix Serick, Prof. Mathias Wambsganß, Prof. Dr.-Ing. Paul W. Schmits and Dipl.-Ing. Christoph Heyen.

The initial editor, Roland Baer, remained a key player in this team and provided both, valuable guidance and leadership, to the other editors and authors.

Figure 1. Cover page of the book Beleuchtungstechnik [1]
III. **BELEUCHTUNGSTECHNIK 4.0**

The final result of the work, the 4th edition of the book Beleuchtungstechnik was available at the international conference “Licht Gemeinschaftstagung” of the lighting associations LiTG (Germany), SLG (Switzerland), LTG (Austria) and NSVV (The Netherlands) in Karlsruhe in September 2016. Figure 1 shows the cover page of the book.

The book is structured into the following chapters:

1. Fundamentals
2. Light Sources and Equipment
3. Luminaires
4. Illumination with Daylight
5. Illumination Systems in Building Interiors
6. Illumination Systems for Exterior Applications
7. Appendices

The book has 496 pages and aims at covering a thorough overview of the various topics. Its main purpose is to provide a good basis for those who study lighting as well as a good handbook for those who work in the field of lighting. In order to use the book for educational services, many efforts have been undertaken to keep its overall sales price low. This goal has been reached so that especially students of universities and universities of applied science can afford it. This new edition of the book is already in use in lighting courses provided by universities and universities of applied science in different countries.

Chapter 1 explains the relevant fundamental knowledge which has been expanded to consider the relevance to LED technology (e.g., optical lenses for LED applications). The topic colorimetry has also been extended and is now a section on its own. Figure 2 shows a picture from the colorimetry section.

![Example figure on colorimetry, taken from [1]](image)

The new edition of Beleuchtungstechnik also addresses the non-visual effects of light and points out the difference between the visual response and the melanopic response to visual radiation. This field represents a topic area in which still a lot of research is happening so it underlines the importance of considering non-visual aspects of lighting for lighting design. Figure 3 is an example of how the image forming and non-image forming effects of light are being processed in the human organism.
After introducing the fundamental knowledge relevant to light and lighting, chapters 2 and 3 look at the generation and distribution of light via lamps and luminaires. Both of these chapters address the conventional light sources but also introduce the solid-state lighting technologies. By this, they complete the overview and address the entirety of today’s lighting technologies available on the market. As an example, figure 4 shows the variations of different LED spectra which shows the complexity of correctly applying solid state lighting technology.

Chapter 4 takes a look at the natural lighting available to us. Designing buildings with harvesting daylight in mind offers many challenges but can provide very rewarding results. The chapter provides an overview of key aspects of daylighting and explains means to control the amount of daylight entering a building such that an acceptable level of visual comfort can be maintained.

The last two chapters look at the application of lighting technologies introduced in the previous chapters. Both chapters follow the general line of introducing the recommendations in place followed by describing the design process.

Chapter 5 “Illumination Systems in Building Interiors” enhances the “traditional” set of quality criteria for lighting. Many of these additional items cannot easily be described or measured but yet form a means for comparing different lighting solutions. The chapter continues to describe the combined use of daylight and artificial light, the lighting design approach as well as economic considerations. Relatively new approaches like dynamic lighting and perception based lighting design are also touched upon.

Chapter 6 “Illumination Systems for Exterior Applications” forms a completely new chapter to the book and completes the application fields for lighting. Next to the applications street lighting and tunnel lighting, the chapter also focuses on outdoor work spaces, sports lighting as well as architectural lighting. Within the latter topic, the
chapter underlines the need for a masterplan so that the lighting solution integrates in a harmonic way in the overall urban context.

IV. USE FOR (CONTINUOUS) PROFESSIONAL DEVELOPMENT

There are two key target groups for this book: professionals and future professionals in the field of lighting. The book serves as both, a collection of knowledge as well as a reference to look up particular topics. These two uses correspond to the aforementioned target groups.

The structure of the chapters forms a sort of study guide that establishes a solid foundation by introducing the fundamentals. This knowledge is essential to understand the following chapters. Next to the chapters on generating and distributing electric light (lamps and luminaires), the chapter on daylighting introduces the natural light and means to control its utilization in building interiors. The last two chapters deal with the application of lighting systems in the built environment for interior and exterior applications.

To a large extent, this structure is aligned with most approaches of lighting courses taught at German universities and universities of applied science.

Lighting professionals use this book as a reference for refreshing their knowledge on particular topics or getting a quick overview on topics they are not yet familiar with. From that perspective, the book “Beleuchtungstechnik” supports the continuous professional development or similar efforts when preparing for the exam to achieve the qualification European Lighting Expert [2].

V. SUMMARY

The new edition of the book Beleuchtungstechnik is a completely revised version of the book. It includes aspects for Solid State Lighting and forms an up to date fundamental book suitable for students and professionals interested in the field of lighting. It supports the education at universities and universities of applied science as well as continuous professional development such as preparation for the European Lighting Expert (ELE) exam offered by member institutions of the European Lighting Expert Association (ELEA).

The book Beleuchtungstechnik continues to be one of the top selling lighting education books in the German language. First steps towards checking the feasibility of publishing this book also in English have recently been taken.

ACKNOWLEDGEMENTS

The authors would like to thank the entire team of authors and reviewers for their contribution and dedication towards the completion of the book. Furthermore, we thank the publisher Huss-Medien GmbH for all the support provided all along.

Special thanks go to Roland Baer. Nearly 30 years ago, he published the first edition of Beleuchtungstechnik which has since formed the basis of the lighting education of many professionals who are now working and contributing towards the success of the lighting industry. His vision back then, his efforts along the way as well as his dedication towards this project have been inspiring for all of us and provided us with the energy required to complete this work!

REFERENCES
