

Understanding LED Illumination

By M. Nisa Khan

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Understanding LED Illumination elucidates the science of lighting for light emitting diodes. It presents concepts, theory, simulations, and new design techniques that shine the spotlight on illumination, energy efficiency, and reducing electrical power consumption. The text provides an introduction to the fundamentals of LED lamp design, and highlights the principles of large-space and 3D object illumination for developing competitive LED lamps.

The first part of the book discusses lamp output metrics and characterization methods, while the second part of the book explores certain retail and prototype lamp comparisons with theory, simulations and experiments It details the light propagation and distribution characteristics of LED light sources for general illumination applications, and presents design and simulation requirements for LED lamps suited for real-world applications. It also addresses light generation, efficiency, theoretical limits, efficiency limiting factors, and LED lamp design elements.

- Emphasizes the lighting aspects for LED lamps: quality and improvement
- Describes the basics of junction diode and the intricacies of compound semiconductor optoelectronic properties including the thermal, electrical, optical, and mechanical aspects
- Explains the challenges of LED lighting in scientific and mathematical terms
- Includes case studies from Osram Optosemiconductors, Sylvania, and Phillips, GE, and others

The book characterizes several LED replacement lamps for household and commercial lighting and discusses a novel design for improving tubular LED replacements. It takes the mysteries out of solid-state lighting for lighting designers, and helps LED scientists and engineers effectively design their products to provide high-quality illumination.

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Editorial Review

Review

"… [the book] educate[s] a non-lighting audience about the basics of light, while doing so from a point of view that they might understand. … BUY IT if you'd like to see how another community views the lighting world."
?*Lighting Design and Application Magazine*, June 2014

"… one of those rare resources that address the engineering of LED lighting as well as the challenges and opportunities faced by lighting designers working in a rapidly evolving marketplace. Author Nisa Khan's concise and unique perspective brings together key issues related to both the evolution and practice of next-generation lighting. … an excellent textbook for teaching illumination engineering, architectural engineering, and other subjects related to next-generation lighting. The monograph is extremely well organized and its tables, charts, diagrams, and photographs effectively reinforce the concepts described by the text. It can also serve as a ready reference for those involved in the design, engineering, and marketing of SSL. I recommend it to anyone interested in SSL lighting …"
?Michael Siminovitch, *Physics Today*, July 2014

"The book contains a lot of useful information on LEDs, particularly on thermal management and colour stability. … a useful addition to a technical library on luminaire design and manufacturing …"
?*Lighting Magazine*, February/March 2014

"The author provides an introduction to lighting fundamentals and technologies, and then LED science and technologies. Lamp designs, lighting theory, simulations and efficiency limiting factors are discussed as well. The author also addresses LED replacement lamps for household and commercial lighting use, as well as design for improving tubular LED replacement. … designed to teach scientists and engineers the fundamentals of lighting and LED lamp design."
?*Optics & Photonics News*

"**Understanding LED Illumination** provides a very broad look at the subject of LED lighting. There are sections on lighting history, lamp simulation, packaging, human interaction issues, light intensity measurement, energy efficiency, LED vs. fluorescent, etc. … it will appeal to just about any engineer involved with LED design. The book is extremely well illustrated. … an excellent choice for any engineer involved in LED design or manufacturing."
?ThermalSoftware.com

"The most comprehensive introductory book in LED lighting."
?Stephen Y. Chou, Professor, Department of Electrical Engineering, Princeton University

"This book fills a unique need in a growing field. The author discusses such important issues as color blend, color rendering, and 3D illumination, which are not included in standard texts. It will be of great value to students in electrical lighting courses, lighting engineers, architects, and others who make use of this new technology."
?Leonard C. Feldman, Ph.D., Professor and Vice President of Physical Sciences and Engineering Partnerships, Rutgers University

"This book is an invaluable contribution for scientists, industry professionals and educators in the lighting domain."
?Siegfried Luger, EMBE, Luger Research e.U.

About the Author

M. Nisa Khan received her bachelor’s degree in physics and mathematics from Macalester College, St. Paul, Minnesota, and her master’s and PhD degrees in electrical engineering from the University of Minnesota, Minneapolis. In 2006, she started an independent research and engineering company in LED lighting and has been involved in innovation and technology development for making solid-state lighting more suitable for general lighting. Dr. Khan performs feasibility studies for LED lighting used in entertainment and signage industries and offers platform design and development solutions for general lighting applications. Since 2007, she has been writing the "LED Update" column for *Signs of the Times* magazine.

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From reader reviews:

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