

The Seed of a Revolution in Lighting: Light-Emitting Diodes

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This tutorial presents the history, operating principles, and use of light-emitting diodes (LEDs) in lighting applications. The unique strengths of LEDs, when used for lighting applications, will be discussed. These unique strengths include the controllability of the emission spectrum, color temperature, and far-field emission pattern. The unique challenges of LEDs, when used for lighting applications, will be discussed as well. These challenges include the efficiency droop, which has been strongly debated by the technical community during recent years. The origin of the efficiency droop will be discussed including ways to overcome the droop.



E. Fred Schubert has made pioneering contributions to the field of compound semiconductor materials and devices, particularly to the doping of compound semiconductors and to the development and understanding of light-emitting diodes. He is currently on the faculty of Rensselaer Polytechnic Institute in Troy NY. He authored the books *Doping in III-V Semiconductors* (1992), *Delta Doping of Semiconductors* (1996), and *Light-Emitting Diodes* (1st edition 2003 and 2nd edition 2006). He is co-inventor of more than 30 US patents and co-authored more than 275 publications. He is a Fellow of the APS, IEEE, OSA, and SPIE and has received several awards.