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Laser Diode Beam Basics, Manipulations and Characterizations

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Foreword

Many optical design technical books are available for many years. These books mainly deal with image optics design based on geometric optics and using sequential raytracing technique. Some books slightly touched laser beam manipulation optics design. Since the invention of a laser in 1960s, lasers find extensive applications in many areas. Among many types of lasers, laser diodes are unique for their many advantages, such as having a wide range wavelength and power selections, being small; high efficient and able to be modulated to gigahertz and operated by batteries. Because of these advantages, lasers diodes are widely used in fiber optical communications, data storage and read out, sensing and measurement, material processing, etc. Most of these applications require a laser diode beam to have certain size, shape, divergence, intensity distribution etc. In most cases, an optical system needs be built to manipulate the laser diode beam to meet all these requirements.

When design laser diode beam manipulation optics, special attention must be paid to the Gaussian nature of the beam, geometric optics raytracing technique must be modified to avoid causing errors. The Gaussian nature of laser beams is often overlooked by some scientists and engineers who don't have enough knowledge and experience in lasers. Laser diode beams are particularly difficult to manipulate, because these beams have very large divergent angles, are elliptical and astigmatic.

Many books on laser diodes have already been published. These books all extensively deal with laser diode physics with little touching on laser diode beam manipulations and characterizations. On the other hand, some internet resources dealing with laser diode beam manipulations can be found online. To the author's opinion these internet resources have not covered enough materials with enough details on laser diode beam manipulations and characterizations. A technical book concentrated on laser diode beam manipulations and characterizations can provide useful information to laser diode users. To the author's best knowledge, there is still no such a book available. This book tries to address this need.

This book is a summary of the author's many years' industrial experience in laser diode applications, is concentrated on the very practical side of the subject,

and only discusses the basic physics and mathematics that are necessary for the readers in order to understand the subject. This book is intended to provide a practical guidance and reference to those scientists and engineers who are still new to laser diode applications, and to those undergraduate and graduated students who are studying lasers and optics. The author hopes the readers are able to fast and easily find the most practical and useful information about laser diode applications from this book without the need of searching through a sea of information. Since the term “laser optics” is often reserved for laser cavity optics, the term “laser beam manipulation optics” is used in this book to avoid possible confusion.

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