

RECENSIONI



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NOTE DI FOTONICA

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The advent of the laser in 1960 corresponded to a revolution not only in the framework of Optics, but in the general field of Physics, leading to a novel conception of light, to unprecedented precision in measurements, to uncountable ways of acting on our environment via the interaction of light with matter and, consequently, to an extraordinary variety of applications. This profound impact is best represented by the surge of a novel discipline in Physics and Technology, named Photonics, which concerns the generation, the manipulation and the utilization of light. This name was coined to underline the resemblance with the name Electronics, once the role of electrons is replaced by photons.

The aim of this book is to introduce the reader to the domain of Photonics, providing all the basic notions in a well structured vision of such an interdisciplinary field, that encompasses Optics, Electromagnetism, Quantum Mechanics and Materials Science. The approach includes necessary topics such as, for example, electronic circuits and devices, the signal theory and methods of information transmission. A guideline in the selection of topics and of the level of their treatment is given by the criterion that the book be tailored for students of the Master courses in Engineering and in Physics.

Very much in accord with what is said above, the first chapter is devoted to the principles that govern the laser and to the properties of the light emitted by lasers. The basic equations that rule the time evolution of the laser emission are derived and the main categories of laser sources are illustrated. Such an introduction is followed by two chapters that deal with the propagation of light in vacuum and in isotropic and anisotropic materials, respectively. The third chapter discusses also all the optical components which are most commonly used in the manipulation of light beams such as, for example, dielectric and metallic interfaces, dielectric mirrors and beam splitters, thin lenses, spherical mirrors. Fourier optics and spectral measurements are extensively discussed in this framework.

The following three chapters illustrate aspects of fundamental importance for the understanding and the application of photonic techniques. Chapter 4 is devoted to the description of the techniques that allow the modulation of light beams, including the discussion of the linear and quadratic electro-optical effects and of the acusto-optical effect.

Chapter 5 focusses on the topic of semiconductor devices, which includes, for example, semiconductor lasers and amplifiers, Light Emitting Diodes and light detectors. This is especially important also because it describes how light can be generated by an electric current in the laser and, on the other hand, how light can generate an electric current, as it happens in photovoltaic cells.

Optical fibers, which constitute the subject of chapter 6, have become the basic tool for long-distance, low-loss communication. The discussion encompasses their properties, attenuation and dispersion, the propagation of light pulses, optical components in fibers. It also describes how fibers have offered the possibility of realizing novel amplifiers and lasers of great relevance for practical applications.

The final chapter 7 illustrates in a concise manner the main applications of Photonics, such as optical communication and memories, integrated optical circuits, optical metrology and sensing, industrial applications of lasers and LEDs (especially biomedical applications), liquid crystal displays, photovoltaic cells. The emphasis is on methodological aspects.

The treatment is constantly agile but aimed to completeness, and the balance between theoretical and experimental aspects is excellent. Hence the book is useful for many different kinds of readers, not only those who look for an introduction to the field of Photonics. For example, for researchers who are expert in theory and wish to obtain an adequate view of experimental issues or, conversely, for experimentalists who wish to understand the basic theoretical aspects. The whole discussion is maintained at an operational level, with emphasis also on

quantitative aspects, so that the reader is enabled to undertake the project of an experiment or of a device.

In conclusion, the book is adequate to be addressed not only to students of the Master level, but also to doctoral students, to researchers and project planners. Such fields as nonlinear optics and quantum optics are touched only marginally, but their study represents an ideal continuation of the discussion presented in this book.

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