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| Nota di contenuto       | Cover; Microwave Photonic Links; Title Page; Copyright Page; Table of Contents; Preface; Abbreviation Glossary; Chapter 1 General Points; 1.1. Microwave photonic links; 1.2. Link description; 1.3. Signal to transmit; 1.3.1. Microwave signal; 1.3.2. Microwave carrier for a digital signal; 1.3.3. UWB signal; 1.3.4. Optical carrier; 1.3.5. Summary; 1.4. Limitations of microwave photonic links; 1.4.1. Limitations due to the materials constituting the different elements; 1.4.2. Noise sources in microwave photonic links; 1.4.3. Nonlinearities<br>1.5. The components and characteristics of microwave photonic linksChapter 2 Generation and Modulation of Light; 2.1. Laser; 2.1.1. General points; 2.1.2. Semiconductor laser structure and optical gain in the active zone; 2.1.3. Operation of a Fabry-Perot laser; 2.1.4. Optical confinement factor and rate equations; 2.1.5. Static mode of laser operation (or CW mode of operation); 2.1.6. Dynamic mode of laser |

operation: RF small signal response; 2.1.7. RIN laser noise; 2.1.8. Increase in  $1/f$  of RIN and superposition of a small signal and noise; 2.1.9. Different laser configurations 2.1.10. CAD laser models 2.1.11. Laser measurements and temperature stabilization; 2.2. Electro-optic modulator: EOM; 2.2.1. General physical principles; 2.2.2. Pockels or linear electro-optical effect; 2.2.3. Mach-Zehnder electro-optic modulator; 2.2.4. Single-Drive MZM: one driving electrode; 2.2.5. Dual-drive MZM: two driving electrodes; 2.2.6. Real Mach-Zehnder modulator: characteristics and performances; 2.2.7. Mach-Zehnder modulator technology; 2.3. Electro-absorption modulator: EAM; 2.3.1. Electro-absorption effect; 2.3.2. FKE; 2.3.3. Stark effect; 2.3.4. Quantum well structures 2.3.5. MEA operation 2.3.6. Characteristics of an EAM; 2.3.7. EML: EAM integrated to a DFB laser; 2.3.8. EAM electrical modeling for ultra-fast signal simulation; Chapter 3 Optical Fibers and Amplifiers; 3.1. Optical fibers; 3.1.1. General; 3.1.2. Material attenuation; 3.1.3. Material refraction index and dispersion; 3.1.4. Total reflection, numerical aperture, transmitted maximum frequency; 3.1.5. Step-index fiber; 3.1.6. Graded index fiber; 3.1.7. Single-mode fiber; 3.1.8. Plastic optical fibers; 3.2. Optical amplifiers; 3.2.1. Semiconductor optical amplifiers: SOA; 3.2.2. EDFAs 3.3. Appendix: modal analysis of propagation in a fiber 3.3.1. Maxwell equations; 3.3.2. Maxwell equations in a cylindrical fiber; 3.3.3. Continuity and characteristic equation conditions; 3.3.4. Research of different propagation modes; 3.3.5. Approximation of linearly polarized modes; Chapter 4 Photodetectors; 4.1. Photodetector definition; 4.2. Photodiodes; 4.2.1. Presentation; 4.2.2. Light absorption in a semiconductor; 4.2.3. p-i-n photodiode; 4.2.4. Metal-semiconductor-metal or MSM photodiode; 4.2.5. Equivalent circuits for p-i-n and MSM photodiodes; 4.2.6. Nonlinearities 4.2.7. UTC photodiodes

## Sommario/riassunto

This book presents the electrical models for the different elements of a photonic microwave link like lasers, external modulators, optical fibers, photodiodes and phototransistors. The future trends of these components are also introduced: lasers to VCSEL, external modulators to electro-absorption modulators, glass optical fibers to plastic optical fibers, photodiodes to UTC photodiodes or phototransistors. It also describes an original methodology to evaluate the performance of a microwave photonic link, based on the developed electrical models, that can be easily incorporated in