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with Different Functional Split Options; 3.10.1 Bit Rate Dependency on the Split Option; 3.10.2 Bit Rate Calculation; 3.10.3 Latency Calculation; 3.11 Summary; References; Chapter 4 Optical Transmission Modeling in Digital RANs; 4.1 Introduction; 4.2 Fiber Attenuation; 4.3 Performance Metrics in Optical Communication Systems; 4.3.1 Bit Error Rate; 4.3.2 Q Factor; 4.3.3 Optical Modulation Amplitude
4.3.4 Error Vector Magnitude 4.3.5 Optical Signal-to-Noise Ratio; 4.3.6 Using Different Penalty Definitions; 4.4 Optical Receiver Model; 4.5 Fiber Propagation Penalties; 4.5.1 Chromatic Dispersion; 4.5.2 Polarization Mode Dispersion; 4.5.3 Chromatic and Polarization Mode Dispersion Tolerance of Direct Detection Modulation Formats; 4.5.4 Self-Phase Modulation; 4.5.5 Cross-Phase Modulation; 4.5.6 Four-Wave Mixing; 4.6 Stimulated Raman Scattering; 4.6.1 Stimulated Brillouin Scattering; 4.7 Rayleigh Backscattering; 4.8 Summary; References
Chapter 5 Optical Systems and Technologies for Digital Radio Access Networks 5.1 Introduction; 5.2 Point-to-Point Fiber Systems; 5.2.1 Optical Modules for Point-to-Point Links; 5.2.2 Modulation Formats in Point-to-Point Links; 5.3 Dense WDM Systems; 5.3.1 Optical Amplifiers; 5.3.2 Statistical Design of DWDM Links; 5.3.3 Wavelength Dependent Losses and Gains; 5.3.4 Modulation Formats in a DWDM RAN; 5.3.5 Further Considerations on DWDM RANs; 5.4 Mobile Transport over Fixed-Access Networks; 5.4.1 Passive Optical Networks; 5.4.2 Mobile Transport over PON; 5.4.3 Dimensioning of a Backhaul Network

Sommario/riassunto

This hands-on, practical new resource provides optical network designers with basic but necessary information about radio systems air interface and radio access network architecture, protocols, and interfaces, using 5G use cases as relevant example. The book introduces mobile network designers to the transmission modeling techniques for the design of a radio access optical network. The main linear and non-linear propagation effects in optical fiber are covered. The book introduces mobile network designers to the optical technologies used in digital and analog radio access networks, such as optical amplifiers and transmitters, and describes different deployment scenarios, including point-to-point fiber systems, wavelength-division multiplexing systems, and passive optical networks. New integrated photonic technologies for optical switching are also discussed. The book illustrates the principles of optical beamforming and explains how optical technologies can be used to provide accurate phase and frequency control of antenna elements. The new architecture of the optical transport network, driven by the new, challenging requirements that 5G poses in terms of high capacity, high energy efficiency, low latency and low cost is discussed. The use of photonic devices to perform tasks as radio-frequency generation and beamforming, with improved accuracy and cost compared to traditional electronic systems, especially when moving to mm-waves is also explored. Readers also learn the replacement of electric interconnect systems with higher speed and more energy efficient optical lines to perform more effectively computationally demanding baseband processing in 5G. All presented propagation models can be implemented in a spreadsheet, in order to provide the designer with simple rules of thumbs for network planning.
