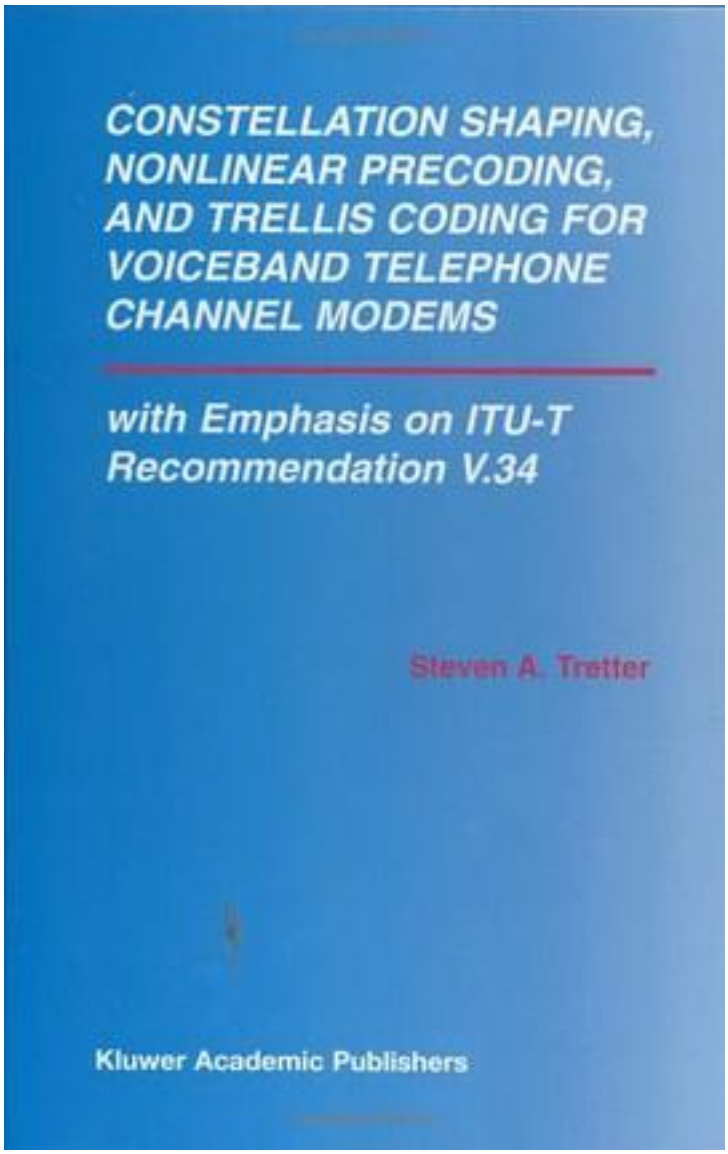
Constellation Shaping, Nonlinear Precoding, and Trellis Coding for Voiceband Telephone Channel Modems



Constellation Shaping, Nonlinear Precoding, and Trellis Coding for Voiceband Telephone Channel Modems_下载链接1_

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This book is an excellent reference for those working in the broad fields of communication theory, information theory, and modem design. It is essential for researchers in modulation and coding for voiceband telephone line modems; signal constellation design; nonlinear precoding for modems; and trellis coding.The author presents the theory behind the new modulation and coding techniques included in ITU-T Recommendation V.34. Topics discussed include signal constellation shaping by shell mapping, nonlinear precoding, four-dimensional trellis codes, and fast equalizer training by using periodic sequences and FFT methods. In addition, several approaches that were considered but not accepted are presented including trellis shaping, trellis precoding, and modulus conversion. The book is essentially a history of the standard for a state-of-the-art voiceband telephone channel modem. Many of these techniques were invented during the committee deliberations. The rapid advances in digital signal processor technology allowed the committee to consider approaches that were significantly more complex and effective than anything implemented previously.The first chapter presents the basics of lattices and is the foundation for multi-point constellation design. The second chapter discusses the theoretical properties of large constellations including shaping gain, constellation expansion ratio, and peak-to-average ratio. Chapter 3 presents the elements of convolutional and trellis codes for reference purposes. A technique for constellation shaping called trellis shaping is presented in Chapter 4. Chapter 5 examines methods for nonlinear channel precoding. Chapter 6 discusses the combination of the trellis precoding and nonlinear precoding methods of Chapters 4 and 5 into a technique called trellis precoding. Another method of assigning data bits to constellation point called modulus conversion is discussed in Chapter 7. The shell mapping method of constellation shaping is presented in Chapter 8. The four-dimensional constellation used by V.34 modems is discussed in Chapter 9. The combination of shell mapping, precoding, and trellis coding arranged in a feedback loop that was selected for Recommendation V.34 is the topic of Chapter 10. Finally, Chapter 10 presents the theory of a special type of periodic sequence called a CAZAC sequence and shows how an adaptive equalizer can be rapidly trained using these periodic sequences and FFT methods.Much of the material has never been published in a book before, but exists only in journal articles and ITU-T working papers. These topics include trellis shaping, LTF precoding, trellis precoding, modulus conversion, shell mapping, the V.34 four-dimensional constellation, the combination of shell mapping, precoding and trellis coding in a feedback arrangement, and CAZAC sequences.The book will interest any professional involved with modem design. It is also suitable as a text for an advanced course in modulation and coding at the graduate level.

作者介绍:

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