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Codes Adaptive Hybrid ARQ Using Convolutional and Turbo Codes on Fading Channels, and Its Application to the Third-generation Wireless Communications Repeat--punctured Turbo Codes and Superorthogonal Convolutional Turbo Codes High-Speed decoding of convolutional Turbo Codes Channel Coding in Communication Networks Introduction to Convolutional Codes with Applications Digital Communications with Emphasis on Data Modems Communications, Signal Processing, and Systems Low Complexity Capacity-approaching Codes for Data Transmission Hardware Implementation of Non-binary Turbo Code for DVB/RCS. A Practical Guide to Error-Control Coding Using MATLAB On Rate-Compatible Insertion Convolutional Turbo Codes and HARQ for Mobile Communications Coding Theory Advances in Communications, Computing, Electronics, Networks, Robotics and Security Volume 12 Applications of Constrained Turbo Block Convolutional Codes Channel Codes Iterative Error Correction

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One of the most important key technologies for digital communication systems as well as storage media is coding theory. It provides a means to transmit information across time and space over noisy and unreliable communication channels. Coding Theory: Algorithms, Architectures and Applications provides a concise overview of channel coding theory and practice, as well as the accompanying signal processing architectures. The book is unique in presenting algorithms, architectures, and applications of coding theory in a unified framework. It covers the basics of coding theory before moving on to discuss algebraic linear block and cyclic codes, turbo codes and low density parity check codes and space-time codes. Coding Theory provides algorithms and architectures used for implementing coding and decoding strategies as well as coding schemes used in practice especially in communication systems. Feature of the book include: Unique presentation-like style for summarising main aspects Practical issues for implementation of coding techniques Sound theoretical approach to practical, relevant coding methodologies Covers standard coding schemes such as block and convolutional codes, coding schemes such as Turbo and LDPC codes, and space time codes currently in research, all covered in a common framework with respect to their applications. This book is ideal for postgraduate and undergraduate students of communication and information engineering, as well as computer science students. It will also be of use to engineers working in the industry who want to know more about the theoretical basics of coding theory and their application in currently relevant communication systems Introduction to Convolutional Codes with Applications is an introduction to the basic concepts of convolutional codes, their structure and classification, various error correction and decoding techniques for convolutionally encoded data, and some of the most common applications. The definition and representations, distance properties, and important classes of convolutional codes are also discussed in detail. The book provides the first comprehensive description of table-driven correction and decoding of convolutionally encoded data. Complete examples of Viterbi, sequential, and majority-logic decoding technique are also included, allowing a quick comparison among the different decoding approaches. Introduction to Convolutional Codes with Applications summarizes the research of the last two decades on applications of convolutional codes in hybrid ARQ protocols. A new classification allows a natural way of studying the underlying concepts of hybrid schemes and accommodates all of the new research. A novel application of fast decodable invertible convolutional codes for lost packet recovery in high speed networks is described. This opens the door for using convolutional coding for error recovery in high speed networks. Practicing communications, electronics, and networking engineers who want to get a better grasp of the underlying concepts of convolutional coding and its applications will greatly benefit by the simple and concise style of explanation. An up-to-date bibliography of over 300 papers is included. Also suitable for use as a textbook or a reference text in an advanced course on coding theory with emphasis on convolutional codes. This book is devoted to one of the essential functions of modern telecommunications systems: channel coding or error correction coding. Its main topic is iteratively decoded algebraic codes, convolutional codes and concatenated codes. In recent years, Parallel Concatenated Convolutional Codes, commonly known as turbo codes, have demonstrated extraordinary performance results. The reasons remain only partly understood, and the design of good turbo codes has been largely a matter of guesswork. This dissertation addresses many of the design issues, including interleaver design, selection of the constituent Binary Convolutional Codes, puncturing, and trellis termination. Design of the interleaver is the most difficult of these. Beginning with a mathematical structure of interleavers, the most significant categories of decoding errors are identified. After an investigation of interleavers designed for weight two messages, several practical interleaver design goals are identified. These goals, including irregularity, separation parameters, and design against particular error patterns, motivate an interleaver design algorithm. From the dominant types of errors, design criteria are also developed for the selection of the Binary Convolutional Codes and puncturing patterns. Trellis termination is also addressed, and analytical performance estimates are derived for several termination schemes. Together, this work forms a complete set of algorithms for turbo code design and performance estimation. Simulations of the resulting turbo codes confirm the excellent performance estimates. Trellis and turbo coding are used to compress and clean communications signals to allow greater bandwidth and clarity Presents the basics, theory, and applications of these techniques with a focus on potential standard state-of-the art methods in the future Provides a classic basis for anyone who works in the area of digital communications A Wiley-IEEE Press Publication This book uses a practical approach in the application of theoretical concepts to digital communications in the design of software defined radio modems. This book discusses the design, implementation and performance verification of waveforms and algorithms appropriate for digital data modulation and demodulation in modern communication systems. Using a building-block approach, the author provides an introductory to the advanced understanding of acquisition and data detection using source and executable simulation code to validate the communication system performance with respect to theory and design specifications. The author focuses on theoretical analysis, algorithm design, firmware and software designs and subsystem and system testing. This book treats system designs with a variety of channel characteristics from very low to optical frequencies. This book offers system analysis and subsystem implementation options for acquisition and data detection appropriate to the channel conditions and system specifications, and provides test methods for demonstrating system performance. This book also: Outlines fundamental system requirements and related analysis that must be established prior to a detailed subsystem design Includes many examples that highlight various analytical solutions and case studies that characterize various system performance measures Discusses various aspects of atmospheric propagation using the spherical 4/3 effective earth radius model Examines Ionospheric propagation and uses the Rayleigh fading channel to evaluate link performance using several robust waveform modulations Contains end-of-chapter problems, allowing the reader to further engage with the text Digital Communications with Emphasis on Data Modems is a great resource for communication-system and digital signal processing engineers and students looking for in-depth theory as well as practical implementations. This book presents the journey of Turbo-Codes from their first invention and initial design as error correcting codes to their application as video compression tools. This journey is presented in three milestones. First, Turbo-Codes are introduced as a channel coding tool. Different encoding structures and decoding algorithms are discussed from theoretical and practical aspects, for binary and non-binary Turbo-Codes. Slepian-Wolf and Wyner-Ziv theorems are then discussed, as they constitute the main theory behind distributed source coding (DSC). Turbo-Codes are then presented as a practical tool for distributed source compression. The study of Turbo-Codes application in DSC is also extended to the case of joint source-channel coding (JSCC), where these codes are jointly used for both source compression and error correction. Theoretical models for DSC and JSCC are thoroughly discussed along with the necessary modifications to the initial turbo encoder-decoder system. Different simulation setups are considered and results are presented and analyzed. Finally, Turbo-Code-based distributed video coding (DVC) techniques are discussed. The motivation behind DVC is first presented, followed by a general description of the DVC system model. Different techniques used to generate the side information needed for practical DVC systems are then discussed. Theoretical compression bounds are derived for both error-free and erroneous transmissions. Applications of DVC in the context of single user and multiuser setups are finally presented with different simulation scenarios and performance analysis. This book brings together papers presented at the 2020 International Conference on Communications, Signal Processing, and Systems, which provides a venue to disseminate the latest developments and to discuss the interactions and links between these multidisciplinary fields. Spanning topics ranging from communications, signal processing and systems, this book is aimed at undergraduate and graduate students in Electrical Engineering, Computer Science and Mathematics, researchers and engineers from academia and industry as well as government employees (such as NSF, DOD and DOE). This new edition has been extensively revised to reflect the progress in error control coding over the past few years. Over 60% of the material has been completely reworked, and 30% of the material is original. Convolutional, turbo, and low density parity-check (LDPC) coding and polar codes in a unified framework Advanced research-related developments such as spatial coupling A focus on algorithmic and implementation aspects of error control coding 6. 5 137 7 Performance of BTCs and 139 their Applications 7. 1 Introduction 139 7. 2 Some Results from the Literatures 139 7. 3 Applications of Block Turbo Codes. 142 7. 3. 1 Broadband Wireless Access Standard 144 7. 3. 2 Advanced Hardware Architectures (AHA) 145 7. 3. 3 COMTECH EF DATA 147 7. 3. 4 Turbo Concept 149 7. 3. 5 Paradise Data Com 150 Summary 7. 4 151 8 Implementation Issues 153 8. 1 Fixed-point

Implementation of Turbo Decoder 153 8. 1. 1 Input Data Quantization for DVB-RCS Turbo Codes 155 8. 1. 2 Input Data Quantization for BTC 157 8. 2 The Effect of Correction Term in Max-Log-MAP Algorithm 159 8. 3 Effect of Channel Impairment on Turbo Codes 163 8. 3. 1 System Model for the Investigation of Channel Impairments 163 8. 3. 2 Channel SNR Mismatch 164 8. 3. 2. 1 Simulation Results 165 8. 3. 3 Carrier Phase Recovery 170 8. 3. 3. 1 The Effect of Phase Offset on the Performance of RM Turbo Codes 170 8. 3. 3. 2 The Effect of Preamble Size on the Performance of RM Turbo Codes 170 8. 3. 3. 3 Simulation Results 170 8. 4 Hardware Implementation of Turbo Codes 171 8. 5 Summary 175 9 177 Low Density Parity Check Codes 9. 1 Gallager Codes: Regular Binary LDPC Codes 177 9. 2 Random Block Codes 178 9. 2. 1 Generator Matrix 179 9. 2. Presents all of the key ideas needed to understand, design, implement and analyse iterative-based error correction schemes. Fundamentals of Convolutional Coding, Second Edition, regarded as a bible of convolutional coding brings you a clear and comprehensive discussion of the basic principles of this field Two new chapters on low-density parity-check (LDPC) convolutional codes and iterative coding Viterbi, BCJR, BEAST, list, and sequential decoding of convolutional codes Distance properties of convolutional codes Includes a downloadable solutions manual This book provides a comprehensive overview of the subject ofchannel coding. It starts with a description of information theory,focusing on the quantitative measurement of information andintroducing two fundamental theorems on source and channel coding.The basics of channel coding in two chapters, block codes andconvolutional codes, are then discussed, and for these the authorsintroduce weighted input and output decoding algorithms andrecursive systematic convolutional codes, which are used in therest of the book. Trellis coded modulations, which have their primary applicationsin high spectral efficiency transmissions, are then covered, beforethe discussion moves on to an advanced coding technique calledturbocoding. These codes, invented in the 1990s by C. Berrou and A.Glavieux, show exceptional performance. The differences betweenconvolutional turbocodes and block turbocodes are outlined, and foreach family, the authors present the coding and decodingtechniques, together with their performances. The book concludeswith a chapter on the implementation of turbocodes in circuits. As such, anyone involved in the areas of channel coding anderror correcting coding will find this book to be of invaluableassistance. This book discusses the latest channel coding techniques, MIMO systems, and 5G channel coding evolution. It provides a comprehensive overview of channel coding, covering modern techniques such as turbo codes, low-density parity-check (LDPC) codes, space–time coding, polar codes, LT codes, and Raptor codes as well as the traditional codes such as cyclic codes, BCH, RS codes, and convolutional codes. It also explores MIMO communications, which is an effective method for high-speed or high-reliability wireless communications. It also examines the evolution of 5G channel coding techniques. Each of the 13 chapters features numerous illustrative examples for easy understanding of the coding techniques, and MATLAB-based programs are integrated in the text to enhance readers' grasp of the underlying theories. Further, PC-based MATLAB m-files for illustrative examples are included for students and researchers involved in advanced and current concepts of coding theory. Channel coding lies at the heart of digital communication and data storage, and this detailed introduction describes the core theory as well as decoding algorithms, implementation details, and performance analyses. In this book, Professors Ryan and Lin provide clear information on modern channel codes, including turbo and low-density parity-check (LDPC) codes. They also present detailed coverage of BCH codes, Reed-Solomon codes, convolutional codes, finite geometry codes, and product codes, providing a one-stop resource for both classical and modern coding techniques. Assuming no prior knowledge in the field of channel coding, the opening chapters begin with basic theory to introduce newcomers to the subject. Later chapters then extend to advanced topics such as code ensemble performance analyses and algebraic code design. 250 varied and stimulating end-of-chapter problems are also included to test and enhance learning, making this an essential resource for students and practitioners alike. Serial concatenation can generate low complex powerful codes. Interleaver in a serially concatenated code (SCC) plays a very important role in determining the performance. Traditional methods of interleaver design generally focus either on increasing the minimum distance of the code or increasing the interleaver gain. Recently, a constrained interleaving technique has been introduced to increase the minimum distance while simultaneously maintaining a high interleaver gain. As a result, SCCs constructed with constrained interleaving can perform better than those constructed with traditional interleaving methods. Due to their improved performance, SCCs with constrained interleaving can be constructed with simpler component codes and/or shorter interleaver sizes thereby reducing decoding complexity and decoding delay. In this dissertation, SCCs with constrained interleaving are further examined and their suitability for 100 Gbps and beyond applications in the optical transport network (OTN) is examined. Specifically, this dissertation (a) constructs SCCs with constrained interleaving, (b) derives their asymptotic performance bounds and verifies those bounds using computer simulations, (c) quantifies gains that can be achieved with constrained interleavers over other known interleavers, and (d) designs SCCs using constrained interleaving for applications in OTN. It is demonstrated that SCCs constructed with constrained interleaving perform better than other proposed codes or OTN applications with lower encoding/decoding complexity. This book introduces turbo error correcting concept in a simple language, including a general theory and the algorithms for decoding turbo-like code. It presents a unified framework for the design and analysis of turbo codes and LDPC codes and their decoding algorithms. A major focus is on high speed turbo decoding, which targets applications with data rates of several hundred million bits per second (Mbps). This thesis analyzes the design of low complexity capacity approaching codes suitable for data transmission. The research documented in this thesis describes new and novel design methods for three well-known error control coding techniques, Turbo codes, LDPC block codes and LDPC convolutional codes, which are suitable for implementation in a number of modem digital communication systems. Firstly, we present Partial Unit Memory (PUM) based Turbo codes. A variant of Turbo codes which encompasses the advantages of both block and convolutional codes. The design methods of PUM Turbo codes are presented and Bit Error Rate (BER) simulations and Extrinsic Information Transfer (EXIT) chart analysis illustrates their performance. Partial Unit Memory codes are a class of low complexity, non-binary convolutional codes and have been shown to outperform equivalent convolutional codes. We present the EXIT charts of parallel concatenated PUM codes and PUM Woven Turbo Codes and analyse them to assess their performance compared with standard Turbo code designs. Resulting Extrinsic Information Transfer charts indicate that the proposed PUM-based codes have higher mutual information during iterative decoding than the equivalent Recursive, Systematic, Convolutional Turbo codes (RSC- TC) for the same Eb/No, i.e. the output of the decoders provides a better approximation of the decoded bits. The EXIT chart analysis is supported by BER plots, which confirms the behaviour predicted by the EXIT charts. We show that the concatenated PUM codes outperform the well-known turbo codes in the waterfall region, with comparable performance in the error floor region. In the second section we present Low Density Generator Matrix codes; a variant of LDPC codes that have low complexity encoding and decoding techniques. We present results of three construction methods and describe how LDGM codes can be modified to improve the error-floor region. We describe the design of random, structured and semi-random, semi- structured codes and how, by replacing the identity matrix with a staircase matrix, LDGM codes can show significant improvements in the error-floor region. Furthermore, we analyse the performance of serially concatenated LDGM codes and how they can benefit when we use the modified LDGM codes in either the outer code or the inner code. The results indicate that concatenated LDGM codes that incorporate LDGM staircase codes in the inner code will show improvements in error-floor performance while maintaining near capacity limit performances. While in the case of LDGM staircase codes being used as the outer codes no significant improvements in waterfall or error-floor regions are observed compared to a concatenated scheme that employs an LDGM identity outer code. Finally, we propose a new design of LDPC convolutional code, which we term as time invariant Low Density Parity Check Unit Memory (LDPC-UM) codes. The performance of LDPC block and Low Density Parity Check Unit Memory codes are compared, in each case, the Low Density Parity Check Unit Memory codes performance is at least as good as that of the LDPC block codes from which they are derived. LDPC-UM codes are the convolutional counterparts of LDPC block codes. Here, we describe techniques for the design of low complexity time invariant LDPC-UM codes by unwrapping the Tanner graph of algebraically constructed quasi-cyclic LDPC codes. The Tanner graph is then used to describe a pipelined message passing based iterative decoder for LDPC-UM codes and standard LDPC convolutional codes that outputs decoding results continuously. Covering the full range of channel codes from the most conventional through to the most advanced, the second edition of Turbo Coding, Turbo Equalisation and Space-Time Coding is a self-contained reference on channel coding for wireless channels. The book commences with a historical perspective on the topic, which leads to two basic component codes, convolutional and block codes. It then moves on to turbo codes which exploit iterative decoding by using algorithms, such as the Maximum-A-Posteriori (MAP), Log-MAP and Soft Output Viterbi Algorithm (SOVA), comparing their performance. It also compares Trellis Coded Modulation (TCM), Turbo Trellis Coded Modulation (TTCM), Bit-Interleaved Coded Modulation (BICM) and Iterative BICM (BICM-ID) under various channel conditions. The horizon of the content is then extended to incorporate topics which have found their way into diverse standard systems. These include space-time block and trellis codes, as well as other Multiple-Input Multiple-Output (MIMO) schemes and near-instantaneously Adaptive Quadrature Amplitude Modulation (AQAM). The book also elaborates on turbo equalisation by providing a detailed portrayal of recent advances in partial response modulation schemes using diverse channel codes. A radically new aspect for this second edition is the discussion of multi-level coding and sphere-packing schemes, Extrinsic Information Transfer (EXIT) charts, as well as an introduction to the family of Generalized Low Density Parity Check codes. This new edition includes recent advances in near-capacity turbo-transceivers as well as new sections on multi-level coding schemes and of Generalized Low Density Parity Check codes Comparatively studies diverse channel coded and turbo detected systems to give all-inclusive information for researchers, engineers and students Details EXIT-chart based irregular transceiver designs Uses rich performance comparisons as well as diverse near-capacity design examples Turbo Code Applications: a journey from a paper to realization presents c- temporary applications of turbo codes in thirteen technical chapters. Each chapter focuses on a particular communication technology utilizing turbo codes, and they are written by experts who have been working in related th areas from around the world. This book is published to celebrate the 10 year anniversary of turbo codes invention by Claude Berrou Alain Glavieux and Punya Thitimajshima (1993-2003). As known for more than a decade, turbo code is the astonishing error control coding scheme which its perf- mance closes to the Shannon's limit. It has been honored consequently as one of the seventeen great innovations during the ?rst ?fty years of information theory foundation. With the amazing performance compared to that of other existing codes, turbo codes have been adopted into many communication s- tems and incorporated with various modern industrial standards. Numerous research works have been reported from universities and advance companies worldwide. Evidently, it has successfully revolutionized the digital commu- cations. Turbo code and its successors have been applied in most communications startingfromthegroundorterrestrial systemsofdatastorage,ADSLmodem, and ?ber optic communications. Subsequently, it moves up to the air channel applications by employing to wireless communication systems, and then ?ies up to the space by using in digital video broadcasting and satellite com- nications. Undoubtedly, with the excellent error correction potential, it has been selected to support data transmission in space exploring system as well. Turbo Coding presents a unified view of the revolutionary field of turbo error control coding, summarizing recent results in the areas of encoder structure and performance analysis. The book also introduces new material, including a general theory for the analysis and design of interleavers, and a unified framework for the analysis and design of decoding algorithms. Turbo Coding explains the basics of turbo error control coding in a straightforward manner, while making its potential impact on the design of digital communication systems as clear as possible. Chapters have been provided on the structure and performance of convolutional codes, interleaver design, and the structure and function of iterative decoders. The book also provides insight into the theory that underlies turbo error control, and briefly summarizes some of the ongoing research efforts. Recent efforts to develop a general theory that unites the Viterbi and BCJR algorithms are discussed in detail. A chapter is provided on the newly discovered connection between iterative decoding and belief propagation in graphs, showing that this leads to parallel algorithms that outperform currently used turbo decoding algorithms. Turbo Coding is a primary resource for both researchers and teachers in the field of error control coding. This practical resource provides you with a comprehensive understanding of error control coding, an essential and widely applied area in modern digital communications. The goal of error control coding is to encode information in such a way that even if the channel (or storage medium) introduces errors, the receiver can correct the errors and recover the original transmitted information. This book includes the most useful modern and classic codes, including block, Reed Solomon, convolutional, turbo, and LDPC codes.You find clear guidance on code construction, decoding algorithms, and error correcting performances. Moreover, this unique book introduces computer simulations integrally to help you master key concepts. Including a companion DVD with MATLAB programs and supported with over 540 equations, this hands-on reference provides you with an in-depth treatment of a wide range of practical implementation issues. PREFACE The increasing demand on high data rate and quality of service in wireless communication has to cope with limited bandwidth and energy resources. More than 50 years ago, Shannon has paved the way to optimal usage of bandwidth and energy resources by bounding the spectral efficiency vs. signal to noise ratio trade-off. However, as any information theorist, Shannon told us what is the best we can do but not how to do it [1]. In this view, turbo codes are like a dream come true: they allow approaching the theoretical Shannon capacity limit very closely. However, for the designer who wants to implement these codes, at first sight they appear to be a nightmare. We came a huge step closer in striving the theoretical limit, but see the historical axiom repeated on a different scale: we know we can achieve excellent performance with turbo codes, but not how to realize this in real devices. Les turbocodes sont des codes obtenus par une concaténation de plusieurs codes convolutifs séparés par des entrelaceurs. En 1993, ils ont révolutionné le domaine du codage correcteur d’erreurs en s’approchant à quelques dixièmes de décibels de la limite théorique de Shannon. Ces performances sont d'autant plus remarquables que le principe itératif permet d'en effectuer le décodage avec une complexité matérielle limitée. Le succès des turbocodes s'est traduit par leur introduction dans plusieurs standards de communication. Les besoins croissants dans le domaine des réseaux large bande, nécessitent des implantations hauts débits qui posent de nouvelles problématiques L'objectif de cette thèse est d'étudier des architectures de décodage à haut débit offrant le meilleur compromis en terme de débit sur complexité. Dans un premier temps, nous avons proposé un modèle simple permettant d'exprimer le débit et l'efficacité d'une architecture. Ce modèle appliqué au turbo décodage met en évidence trois paramètres caractéristiques ayant un impact sur le débit et l'efficacité du décodeur : le degré de parallélisme, le taux d'utilisation (activité) des unités de calcul cl la fréquence d'horloge. Nous avons abordé chacun de ces points en explorant un large spectre de possibilités de l'espace de conception allant de la construction conjointe du code et du décodeur à l'optimisation directe des architectures de décodage pour un code ou un ensemble de codes prédéfinis. Nous avons tout d'abord proposé un nouveau schéma de codage appelé turbocodes à roulettes permettant de minimiser la memoire du décodeur par un décodage en parallèle d'un mot de code reçu par plusieurs processeurs à entrée et sortie souples. Afin de résoudre le problème des accès concurrents aux mémoires qui en résulte, nous avons conçu un nouvel entrelaceur hiérarchique. Nous avons ensuite exploré plusieurs solutions permettant d'améliorer l'activité des processeurs utilisation d'une architecture hybride série/parallèle et proposition de nouveaux séquencements au niveau interne des processeurs, et aussi au niveau global en association avec la construction d'entrelaceurs contraints adaptés. Enfin grace à méthode originale de réduction du chemin critique du calcul récursif des métriques de nœuds, nous avons obtenu, sans coût matériel supplémentaire pour un circuit FPGA, un doublement de la fréquence d'horloge du décodeur. La plupart des techniques développées dans cette thèse ont été validées par la réalisation d'un turbo-décodeur pour le standard d'accès sans-fil large bande WiMAX (IEEE 802.16) qui atteint des performances de correction d'erreur excellentes pour un débit atteignant 100 Mbit/s sur un seul circuit FPGA. This book is the twelfth in a series presenting research papers arising from MSc/MRes research projects undertaken by students of the School of Computing and Mathematics at Plymouth University. The publications in this volume are based upon research projects that were undertaken during the 2013/14 academic year. A total of 17 papers are presented, covering many aspects of modern networking and communication technology, including security, mobility, coding schemes and quality measurement. The expanded topic coverage compared to earlier volumes in this series reflects the broadening of our range of MSc programmes. Specifically contributing programmes are: Communications Engineering and Signal Processing, Computer and Information Security, Computer Science, Computing, Electrical and Electronic Engineering, Network Systems Engineering, and Robotics. This book starts with a description of information theory by focusing on the quantitative measurement of information and by introducing two fundamental theorems on source and channel coding. It then discusses the basics of channel coding in two chapters, the first devoted to block codes and the second to convolutional codes. In these two chapters, the authors introduce weighted input and output decoding algorithms and recursive systematic convolutional codes, which are used in the rest of the book.In part one the book covers trellis coded modulations, which have their primary applications in high spectral efficiency transmissions. Part two is devoted to an advanced coding technique called turbo codes. These codes, invented in the 1990s by C. Berrou and A. Glavieux, show exceptional performance being at 0.35 dB of the Shannon theoretical limit. The book distinguishes between convolutional turbo codes and block turbo codes, and for each family, the authors present the coding and decoding principles, together with their performances. The book concludes with a chapter on the implementation of turbo codes in circuits. Turbo coding has opened an exciting new chapter in the design of iterative detection assisted communication systems. Similar dramatic advances have been achieved with the advent of space time coding, when communicating over dispersive fading wireless channels. By assuming no prior knowledge in the field of channel coding, the authors provide a self-contained reference on these stimulating hot topics, concluding at an advanced level. This essential volume is divided into five key parts: 1. Convolutional and Block Coding Introduces the family of convolutional codes, hard and soft-decision Viterbi algorithms and the most prominent classes of block codes, namely Reed-Solomon (RS) and Bose-Chaudhuri-Hocquenghem (BCH) codes, as well as their algebraic and trellis-decoding. 2. Turbo Convolutional and Turbo Block Coding Introduces turbo convolutional codes and details the Maximum A-Posteriori (MAP), Log-MAP and Max-Log-MAP as well as the Soft Output Viterbi Algorithm (SOVA). Investigates the effects of the various turbo codec parameters. Studies the super-trellis structure of turbo codes and characterises turbo BCH codes. Portrays Redundant Residue Number System (RRNS) based codes and their turbo decoding. 3. Coded Modulation: TCM, TTCM, BICM, BICM-ID Studies Trellis Coded Modulation (TCM), Turbo Trellis Coded Modulation (TTCM), Bit-Interleaved Coded Modulation (BICM), Iterative BICM (BICM-ID) and compares them under various channel conditions. 4. Space-Time Block and Space-Time Trellis Coding Introduces space-time codes and studies their performance using numerous channel codecs providing guidelines for system designers. Studies Multiple-Input Multiple-Output (MIMO) based schemes and the concept of near-instantaneously Adaptive Quadrature Amplitude Modulation (AQAM) combined with near-instantaneously adaptive turbo channel coding. 5. Turbo Equalisation Covers the principle in detail, provides theoretical performance bounds for turbo equalisers and includes a study of various turbo equaliser arrangements. Also addresses the problem of reduced implementation complexity and covers turbo equalised space-time trellis codes. If you are looking for a comprehensive treatment covering both classic channel coding techniques and recent advances in this field, then this is the book for you. Researchers, practising engineers and advanced students will all find it both informative and stimulating.