Error Control Coding Fundamentals And Applications Prentice Hall Computer Applications In Electrical Engineerin

The coding problem; Introduction to algebra; Linear codes; Error correction capabilities of linear codes; Important linear block codes; Polynomial rings and galois fields; Linear switching circuits; Cyclic codes; Bose-chaudhuri-hocquenghem codes; Arithmetic codes.

This book discusses both the theory and practical applications of self-correcting data, commonly known as error-correcting codes. The applications included demonstrate the importance of these codes in a wide range of everyday technologies, from smartphones to secure communications and transactions. Written in a readily understandable style, the book presents the authors' twenty-five years of research organized into five parts: Part I is concerned with the theoretical performance attainable by using error correcting codes to achieve communications efficiency in digital communications systems. Part II explores the construction of error-correcting codes and explains the different families of codes and how they are designed. Techniques are described for producing the very best codes. Part III addresses the analysis of low-density parity-check (LDPC) codes, primarily to calculate their stopping sets and low-weight codeword spectrum which determines the performance of th ese codes. Part IV deals with decoders designed to realize optimum performance. Part V describes applications which include combined error correction and detection, public key cryptography using Goppa codes, correcting errors in passwords and watermarking. This book is a valuable resource for anyone interested in error-correcting codes and their applications, ranging from non-experts to professionals at the forefront of research in their field. This book is open access under a CC BY 4.0 license.

The papers in this volume were presented at the CRYPTO '88 conference on theory and applications of cryptography, held in Santa Barbara, California, August 21-25, 1988. The papers were chosen for their perceived originality and often represent preliminary reports on continuing research. The main sections deal with the following topics: Zero-Knowledge, Number Theory, Pseudorandomness, Signatures, Complexity, Protocols, Security, Cryptoanalysis. As such, they will give the committed reader a unique insight into the very latest developments in the field.

Rapid advances in electronic and optical technology have enabled the implementation of powerful error-control codes, which are now used in almost the entire range of information systems with close to optimal performance. These codes and decoding methods are required for the detection and correction of the errors and erasures which inevitably occur in digital information during transmission, storage and processing because of noise, interference and other imperfections. Error-control coding is a complex, novel and unfamiliar area, not yet widely understood and appreciated. This book sets out to provide a clear description of the essentials of the subject, with comprehensive and up-to-date coverage of the most useful codes and their decoding algorithms. A practical engineering and information technology emphasis, as well as relevant background material and fundamental theoretical aspects, provides an in-depth guide to the essentials of Error-Control Coding. Provides extensive and detailed coverage of Block, Cyclic, BCH, Reed-Solomon, Convolutional, Turbo, and Low Density Parity Check (LDPC) codes, together with relevant aspects of Information Theory EXIT chart performance analysis for iteratively decoded error-control techniques Heavily illustrated with tables, diagrams, graphs, worked examples, and exercises Invaluable companion website features slides of figures, algorithm software, updates and solutions to problems Offering a complete overview of Error Control Coding, this book is an indispensable resource for students, engineers and researchers in the areas of telecommunications engineering, communication networks, electronic engineering, computer science, information systems and technology, digital signal processing and applied mathematics.

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.

Coding theory is still a young subject. One can safely say that it was born in 1948. It is not surprising that it has not yet become a fixed topic in the curriculum of most universities. On the other hand, it is obvious that discrete mathematics is rapidly growing in importance. The growing need for mathe maticians and computer scientists in industry will lead to an increase in courses offered in the area of discrete mathematics. One of the most suitable and fascinating is, indeed, coding theory. So, it is not surprising that one more book on this subject now appears. However, a little more justification of the book are necessary. A few years ago it was and a little more history remarked at a meeting on coding theory that there was no book available an introductory course on coding theory (mainly which could be used for for mathematicians but also for students in engineering or computer science). The best known textbooks were either too old, too big, too technical, too much for specialists, etc. The final remark was that my Springer Lecture Notes (# 201) were slightly obsolete and out of print. Without realizing what I was getting into I announced that the statement was not true and proved this by showing several participants the book Inleiding in de Coderingstheorie, a little book based on the syllabus of a course given at the Mathematical Centre in Amsterdam in 1975 (M. C. Syllabus 31).

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.

Error-correcting codes are ubiquitous. They are adopted in almost every modern digital communication and storage system, such as wireless communications, optical communications, Flash memories, computer hard drives, sensor networks, and deep-space probing. New-generation and emerging applications demand codes with better error-correcting capability. On the other hand, the design and implementation of those high-gain error-correcting codes pose many challenges. They usually involve complex mathematical computations, and mapping them directly to hardware often leads to very high complexity. VLSI Architectures for Modern Error-Correcting Codes serves as a bridge connecting advancements in coding theory to practical hardware implementations. Instead of focusing on circuit-level design techniques, the book highlights integrated algorithmic and architectural transformations that lead to great improvements on throughput, silicon area requirement, and/or power consumption in the hardware implementation. The goal of this book is to provide a comprehensive and systematic review of available techniques and architectures, so that they can be easily followed by system and hardware designers to develop en/decoder implementations that meet error-correcting performance and cost requirements. This book can be also used as a reference for graduate-level courses on VLSI design and error-correcting coding. Particular emphases are placed on hard- and soft-decision Reed-Solomon (RS) and

Bose-Chaudhuri-Hocquenghem (BCH) codes, and binary and non-binary low-density parity-check (LDPC) codes. These codes are among the best candidates for modern and emerging applications due to their good error-correcting performance and lower implementation complexity compared to other codes. To help explain the computations and en/decoder architectures, many examples and case studies are included. More importantly, discussions are provided on the advantages and drawbacks of different implementation approaches and architectures.

During the sixteenth century, Cardano wrote a fascinating work called The Book on Games of Chance. In it he gives an extremely candid recount ing and personal appraisal of some aspects of his most remarkable life. * One feature of the book is striking for the modern scientist or mathemati cian accustomed to current publishing practices. It is brought out during Cardano's discussion of his investigations of certain special questions of applied probability, namely, the question of how to win at gambling. His technique is simplicity itself: in fine reportorial style he reveals his proposed strategy for a particular gambling game, giving marvelous motivating arguments which induce the reader to feel warm, heartfelt support for the projected strategy. Then with all the drama that only a ringside seat observation can bring, Cardano announces that he tried the strategy at the casino and ended up borrowing his taxi fare. Undaunted by failure, he analyzes his now fire-tested strategy in detail, mounts new and per suasive arguments, and, ablaze with fresh optimism and replenished resources, charges off to the fray determined to now succeed where he had so often failed before. Along the way, Cardano developed a number of valuable insights about games of chance and produced useful research results which presumably would be of interest in our present-day society. However, he could never publish the results today in journals with all the flair, the mistakes, the failures and minor successes which he exhibits in his book.

Comprehensive introduction to non-binary error-correction coding techniques Non-Binary Error Control Coding for Wireless Communication and Data Storage explores non-binary coding schemes that have been developed to provide an alternative to the Reed – Solomon codes, which are expected to become unsuitable for use in future data storage and communication devices as the demand for higher data rates increases. This book will look at the other significant non-binary coding schemes, including non-binary block and ring trellis-coded modulation (TCM) codes that perform well in fading conditions without any expansion in bandwidth use, and algebraic-geometric codes which are an extension of Reed-Solomon codes but with better parameters. Key Features: Comprehensive and self-contained reference to non-binary error control coding starting from binary codes and progressing up to the latest non-binary codes Explains the design and construction of good non-binary codes with descriptions of efficient non-binary decoding algorithms with applications for wireless communication and high-density data storage Discusses the application to specific cellular and wireless channels, and also magnetic storage channels that model the reading of data from the magnetic disc of a hard drive. Includes detailed worked examples for each coding scheme to supplement the concepts described in this book Focuses on the encoding, decoding and performance of both block and convolutional non-binary codes, and covers the Kötter-Vardy algorithm and Non-binary LDPC codes This book will be an excellent reference for researchers in the wireless communication and data storage communities, as well as development/research engineers in telecoms and storage companies. Postgraduate students in these fields will also find this book of interest.

Modern error control coding methods based on turbo coding have essentially solved the problem of reliable data communications over noisy channels. Contemporary Coding Techniques and Applications for Mobile Communications provides a clear, comprehensive, and practical grounding on the subject matter, examining the fundamentals, theory, and application of contemporary coding techniques and the applications for mobile communications. Written from the perspective that error control coding techniques will facilitate future digital data links, the book provides in-depth coverage on topics such as modulation techniques, multiplexing, channel models, MIMO systems, fundamental coding techniques, trellis coding modulation, turbo codes, and multilevel turbo codes. The first part of the text presents fundamental information on modulation, multiplexing, channel models, and traditional coding methods. The second part explains advanced coding techniques, provides simulation results, and compares them with related methods. It also provides new coding algorithms and new research areas such as image transmission with step-by-step guidelines.

An introduction to the theory of error-correction codes, and in particular to linear block codes is provided in this book. It considers such codes as Hamming codes and Golay codes, correction of double errors, use of finite fields, cyclic codes, BCH codes and weight distributions, as well as design of codes. In this second edition, the author includes more material on non-binary code and cyclic codes. In addition some proofs have been simplified and there are many more examples and problems. The text has been aimed at mathematicians, electrical engineers and computer scientists.

Error-correction coding is being used on an almost routine basis in most new communication systems. Not only is coding equipment being used to increase the energy efficiency of communication links, but coding ideas are also providing innovative solutions to many related communication problems. Among these are the elimination of intersymbol interference caused by filtering and multipath and the improved demodulation of certain frequency modulated signals by taking advantage of the "natural" coding provided by a continuous phase. Although several books and nu merous articles have been written on coding theory, there are still noticeable deficiencies. First, the practical aspects of translating a specific decoding algorithm into actual hardware have been largely ignored. The information that is available is sketchy and is widely dispersed. Second, the information required to evaluate a particular technique under situations that are en countered in practice is available for the most part only in private company reports. This book is aimed at correcting both of these problems. It is written for the design engineer who must build the coding and decoding equipment and for the communication system engineer who must incorporate this equipment into a system. It is also suitable as a senior-level or first-year graduate text for an introductory one-semester course in coding theory. The book U"Ses a minimum of mathematics and entirely avoids the classical theorem/proof approach that is often seen in coding texts.

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.

An accessible textbook that uses step-by-step explanations, relatively easy mathematics and numerous examples to aid student understanding.

Quantum Information Processing and Quantum Error Correction is a self-contained, tutorial-based introduction to quantum information, quantum computation, and quantum error-correction. Assuming no knowledge of quantum mechanics and written at an intuitive level suitable for the engineer, the book gives all the essential principles needed to design and implement quantum electronic and photonic circuits. Numerous examples from a wide area of application are given to show how the principles can be implemented in practice. This book is ideal for the electronics, photonics and computer engineer who requires an easy- to-understand foundation on the principles of quantum information processing and quantum error correction, together with insight into how to develop quantum electronic and photonic circuits. Readers of this book will be ready for further study in this area, and will be prepared to perform independent research. The reader completed the book will be able design the information processing circuits, stabilizer codes, Calderbank-Shor-Steane (CSS) codes, subsystem codes, topological codes and entanglement-assisted quantum error correction codes; and propose corresponding physical implementation. The reader completed the book will be proficient in quantum fault-tolerant design as well. Unique Features Unique in covering both quantum information processing and quantum error correction - everything in one book that an engineer needs to understand and implement quantum-level circuits. Gives an intuitive understanding by not assuming knowledge of quantum mechanics, thereby avoiding heavy mathematics. In-depth coverage of the design and implementation of quantum information processing and quantum error correction circuits. Provides the right balance among the quantum mechanics, quantum error correction, quantum computing and quantum communication. Dr. Djordjevic is an Assistant Professor in the Department of Electrical and Computer Engineering of College of Engineering, University of Arizona, with a joint appointment in the College of Optical Sciences. Prior to this appointment in August 2006, he was with University of Arizona, Tucson, USA (as a Research Assistant Professor); University of the West of England, Bristol, UK; University of Bristol, Bristol, UK; Tyco Telecommunications, Eatontown, USA; and National Technical University of Athens, Athens, Greece. His current research interests include optical networks, error control coding, constrained coding, coded modulation, turbo equalization, OFDM applications, and quantum error correction. He presently directs the Optical Communications Systems Laboratory (OCSL) within the ECE Department at the University of Arizona. Provides everything an engineer needs in one tutorial-based introduction to understand and implement quantum-level circuits Avoids the heavy use of mathematics by not assuming the previous knowledge of quantum mechanics Provides in-depth coverage of the design and implementation of quantum information processing and quantum error correction circuits

An unparalleled learning tool and guide to error correction coding Error correction coding techniques allow the detection and correction of errors occurring during the transmission of data in digital communication systems. These techniques are nearly universally employed in modern communication systems, and are thus an important component of the modern information economy. Error Correction Coding: Mathematical Methods and Algorithms provides a comprehensive introduction to both the theoretical and practical aspects of error correction coding, with a presentation suitable for a wide variety of audiences, including graduate students in electrical engineering, mathematics, or computer science. The pedagogy is arranged so that the mathematical concepts are presented incrementally, followed immediately by applications to coding. A large number of exercises expand and deepen students' understanding. A unique feature of the book is a set of programming laboratories, supplemented with over 250 programs and functions on an associated Web site, which provides hands-on experience and a better understanding of the material. These laboratories lead students through the implementation and evaluation of Hamming codes, CRC codes, BCH and R-S codes, convolutional codes, turbo codes, and LDPC codes. This text offers both "classical" coding theory-such as Hamming, BCH, Reed-Solomon, Reed-Muller, and convolutional codes-as well as modern codes and decoding methods, including turbo codes, LDPC codes, repeat-accumulate codes, space time codes, factor graphs, soft-decision decoding, Guruswami-Sudan decoding, EXIT charts, and iterative decoding. Theoretical complements on performance and bounds are presented. Coding is also put into its communications and information theoretic context and connections are drawn to public key cryptosystems. Ideal as a classroom resource and a professional reference, this thorough guide will benefit electrical and computer engineers, mathematicians, students, researchers, and scientists.

Although devoted to constructions of good codes for error control, secrecy or data compression, the emphasis is on the first direction. Introduces a number of important classes of error-detecting and error-correcting codes as well as their decoding methods. Background material on modern algebra is presented where required. The role of error-correcting codes in modern cryptography is treated as are data compression and other topics related to information theory. The definition-theorem proof style used in mathematics texts is employed through the book but formalism is avoided wherever possible.

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As computers become more complex, the number and complexity of the tasks facing the computer architect have increased. Computer performance often depends in complex way on the design parameters and intuition that must be

supplemented by performance studies to enhance design productivity. This book introduces computer architects to computer system performance models and shows how they are relatively simple, inexpensive to implement, and sufficiently accurate for most purposes. It discusses the development of performance models based on queuing theory and probability. The text also shows how they are used to provide quick approximate calculations to indicate basic performance tradeoffs and narrow the range of parameters to consider when determining system configurations. It illustrates how performance models can demonstrate how a memory system is to be configured, what the cache structure should be, and what incremental changes in cache size can have on the miss rate. A particularly deep knowledge of probability theory or any other mathematical field to understand the papers in this volume is not required.

This textbook takes a unified view of the fundamentals of wireless communication and explains cutting-edge concepts in a simple and intuitive way. An abundant supply of exercises make it ideal for graduate courses in electrical and computer engineering and it will also be of great interest to practising engineers.

Fundamentals of Codes, Graphs, and Iterative Decoding is an explanation of how to introduce local connectivity, and how to exploit simple structural descriptions. Chapter 1 provides an overview of Shannon theory and the basic tools of complexity theory, communication theory, and bounds on code construction. Chapters 2 - 4 provide an overview of "classical" error control coding, with an introduction to abstract algebra, and block and convolutional codes. Chapters 5 - 9 then proceed to systematically develop the key research results of the 1990s and early 2000s with an introduction to graph theory, followed by chapters on algorithms on graphs, turbo error control, low density parity check codes, and low density generator codes.

A comprehensive introduction to the complex fields of signal coding and signal processing.

Error-controlled coding techniques are used to detect and/or correct errors that occur in the message transmission in a digital communications system. Wireless personal channels used by mobile communications systems and storage systems for digital multimedia data all require the implementation of error control coding methods. Demonstrating the role of coding in communication and data storage system design, this text illustrates the correct use of codes and the selection of the right code parameters. Relevant decoding techniques and their implementation are discussed in detail.

Providing communication systems engineers and students with guidance in the application of error-control coding, this book emphasizes the fundamental concepts of coding theory while minimising the use of mathematical tools. * Reader-friendly approach ti coding in communication systems providing examples of encoding and decoding, information theory and criteria for code selection * Thorogh descriptions of relevant application, including telephony on satellite links, GSM, UMTS and multimedia standards, CD, DVD and MPEG * Provides coverage of the fundamentals of coding and the applications of codes to the design of real error control systems * End of chapter problems to test and develop understanding

Covering the fast evolving area of advanced coding, Error Control Coding for B3G/4G Wireless Systems targets IMT-Advanced systems to present the latest findings and implementation solutions. The book begins by detailing the fundamentals of advanced coding techniques such as Coding, Decoding, Design, and Optimization. It provides not only state-of-the-art research findings in 3D Turbo-codes, non-binary LDPC Codes, Fountain, and Raptor codes, but also insights into their real-world implementation by examining hardware architecture solutions, for example VLSI complexity, FPGA, and ASIC. Furthermore, special attention is paid to Incremental redundancy techniques, which constitute a key feature of Wireless Systems. A promising application of these advanced coding techniques, the Turbo-principle (also known as iterative processing), is illustrated through an in-depth discussion of Turbo-MIMO, Turbo-Equalization, and Turbo-Interleaving techniques. Finally, the book presents the status of major standardization activities currently implementing such techniques, with special interest in 3GPP UMTS, LTE, WiMAX, IEEE 802.11n, DVB-RCS, DVB-S2, and IEEE 802.22. As a result, the book coherently brings together academic and industry vision by providing readers with a uniquely comprehensive view of the whole topic, whilst also giving an understanding of leading-edge techniques. Includes detailed coverage of coding, decoding, design, and optimization approaches for advanced codes Provides up to date research findings from both highly reputed academics and industry standpoints Presents the latest status of standardization activities for Wireless Systems related to advanced coding Describes real-world implementation aspects by giving insights into architecture solutions for both LDPC and Turbo-codes Examines the most advanced and promising concepts of turbo-processing applications: Turbo-MIMO, Turbo-Equalization, Turbo-Interleaving

Most coding theory experts date the origin of the subject with the 1948 publication of A Mathematical Theory of Communication by Claude Shannon. Since then, coding theory has grown into a discipline with many practical applications (antennas, networks, memories), requiring various mathematical techniques, from commutative algebra, to semi-definite programming, to algebraic geometry. Most topics covered in the Concise Encyclopedia of Coding Theory are presented in short sections at an introductory level and progress from basic to advanced level, with definitions, examples, and many references. The book is divided into three parts: Part I fundamentals: cyclic codes, skew cyclic codes, quasi-cyclic codes, self-dual codes, codes and designs, codes over rings, convolutional codes, performance bounds Part II families: AG codes, group algebra codes, few-weight codes, Boolean function codes, codes over graphs Part III applications: alternative metrics, algorithmic techniques, interpolation decoding, pseudo-random sequences, lattices, quantum coding, space-time codes, network coding, distributed storage, secret-sharing, and code-based-cryptography. Features Suitable for students and researchers in a wide range of mathematical disciplines Contains many examples and references Most topics take the reader to the frontiers of research

Fundamentals of Error Correcting Codes is an in-depth introduction to coding theory from both an engineering and mathematical viewpoint. As well as covering classical topics, there is much coverage of techniques which could only be found in specialist journals and book publications. Numerous exercises and examples and an accessible writing style

make this a lucid and effective introduction to coding theory for advanced undergraduate and graduate students, researchers and engineers, whether approaching the subject from a mathematical, engineering or computer science background.

Codes, Kodierung (Telegrafie) ; Kodierung, Datendarstellung, Bit, Byte (EDV).

Essentials of Error-Control Coding Techniques presents error-control coding techniques with an emphasis on the most recent applications. It is written for engineers who use or build error-control coding equipment. Many examples of practical applications are provided, enabling the reader to obtain valuable expertise for the development of a wide range of error-control coding systems. Necessary background knowledge of coding theory (the theory of error-correcting codes) is also included so that the reader is able to assimilate the concepts and the techniques. The book is divided into two parts. The first provides the reader with the fundamental knowledge of the coding theory that is necessary to understand the material in the latter part. Topics covered include the principles of error detection and correction, block codes, and convolutional codes. The second part is devoted to the practical applications of error-control coding in various fields. It explains how to design cost-effective error-control coding systems. Many examples of actual error-control coding systems are described and evaluated. This book is particularly suited for the engineer striving to master the practical applications of error-control coding. It is also suitable for use as a graduate text for an advanced course in coding theory.

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

028M> A reorganized and comprehensive major revision of a classic book, this edition provides a bridge between introductory digital communications and more advanced treatment of information theory. Completely updated to cover the latest developments, it presents state-of-the-art error control techniques. 028M> Coverage of the fundamentals of coding and the applications of codes to the design of real error control systems. Contains the most recent developments of coded modulation, trellises for codes, soft-decision decoding algorithms, turbo coding for reliable data transmission and other areas. There are two new chapters on Reed-Solomon codes and concatenated coding schemes. Also contains hundreds of new and revised examples; and more than 200 illustrations of code structures, encoding and decoding circuits and error performance of many important codes and error control coding systems. 028M> Appropriate for those with minimum mathematical background as a comprehensive reference for coding theory.

This is a concise presentation of the concepts underlying the design of digital communication systems, without the detail that can overwhelm students. Many examples, from the basic to the cutting-edge, show how the theory is used in the design of modern systems and the relevance of this theory will motivate students. The theory is supported by practical algorithms so that the student can perform computations and simulations. Leading edge topics in coding and wireless communication make this an ideal text for students taking just one course on the subject. Fundamentals of Digital Communications has coverage of turbo and LDPC codes in sufficient detail and clarity to enable hands-on implementation and performance evaluation, as well as 'just enough' information theory to enable computation of performance benchmarks to compare them against. Other unique features include space-time communication and geometric insights into noncoherent communication and equalization.

The purpose of Error-Control Coding for Data Networks is to provide an accessible and comprehensive overview of the fundamental techniques and practical applications of the error-control coding needed by students and engineers. An additional purpose of the book is to acquaint the reader with the analytical techniques used to design an error-control coding system for many new applications in data networks. Error~control coding is a field in which elegant theory was motivated by practical problems so that it often leads to important useful advances. Claude Shannon in 1948 proved the existence of error-control codes that, under suitable conditions and at rates less than channel capacity, would transmit error-free information for all practical applications. The first practical binary codes were introduced by Richard Hamming and Marcel Golay from which the drama and excitement have infused researchers and engineers in digital communication and error-control coding for more than fifty years. Nowadays, error-control codes are being used in almost all modem digital electronic systems and data networks. Not only is coding equipment being implemented to increase the energy and bandwidth efficiency of communication systems, but coding also provides innovative solutions to many related data-networking problems.

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The work introduces the fundamentals concerning the measure of discrete information, the modeling of discrete sources without and with a memory, as well as of channels and coding. The understanding of the theoretical matter is supported by many examples. One particular emphasis is put on the explanation of Genomic Coding. Many examples throughout the book are chosen from this particular area and several parts of the book are devoted to this exciting implication of coding.