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Essentials of Error-Control Coding Error Control for Network-on-Chip Links Error-Control Coding for Data Networks Error Control Methods for an Automatic Checkout System A Practical Guide to Error-control Coding Using Matlab Transient and Permanent Error Control for Networks-on-Chip Codes for Error Detection Practical Error Correction Design for Engineers Error-Control Techniques for Digital Communication Error Control Through Coding. Volume I. Summary of Results Proceedings of the ACM. Theory and Practice of Error Control Codes Error Control Coding Introduction to Error Control Codes New Bounds and Constructions for Error Control Codes Power System Control and Protection Codes for Error Control and Synchronization Advanced Hardware Design for Error Correcting Codes The Art of Error Correcting Coding How We Master Our Fate Jorge Castiñeira Moreira Bo Fu Irving S. Reed Theodore S. Lewis Yuan Jiang Qiaoyan Yu Torleiv Kløve Arnold M. Michelson INTERNATIONAL BUSINESS MACHINES CORP BETHESDA MD. Association for Computing Machinery. Conference Richard E. Blahut Peter Sweeney Salvatore Gravano Nasir Ali Al-darwish B. Don Russell Djimitri Wiggert Cyrille Chavet Robert H. Morelos-Zaragoza Ursula Newell Gestefeld

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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 book provides readers with a comprehensive review of the state of the art in error control for network on chip noc links coverage includes detailed description of key issues in noc error control faced by circuit and system designers as well as practical error control techniques to minimize the impact of these errors on system performance

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

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

this book addresses reliability and energy efficiency of on chip networks using cooperative error control it describes an efficient way to construct an adaptive error control codec capable of tracking noise conditions and adjusting the error correction strength at runtime methods are also presented to tackle joint transient and permanent error correction exploiting the redundant resources already available on chip a parallel and flexible network simulator is also introduced which facilitates examining the impact of various error control methods on network on chip performance

there are two basic methods of error control for communication both involving coding of the messages with forward error correction the codes are used to detect and correct errors in a repeat request system the codes are used to detect errors and if there are errors request a retransmission error detection is usually much simpler to implement than error correction and is widely used however it is given a very cursory treatment in almost all textbooks on coding theory only a few older books are devoted to error detecting codes this book begins with a short introduction to the theory of block codes with emphasis on the parts important for error detection the weight distribution is particularly important for this application and is treated in more detail than in most books on error correction a detailed account of the known results on the probability of undetected error on the q ary symmetric channel is also given

this practical handbook provides communication systems engineers with guidance in the application of error control coding it emphasizes the fundamental concepts of coding theory while minimizing the use of mathematical tools demonstrates the role of coding in communication system design shows the performance gains achievable with coding illustrates how codes should be used and how to select the right code parameters discusses the decoding techniques that should be considered and how they are implemented and examines how detailed performance results are obtained

the research was primarily devoted to the application of error control techniques this discipline has developed a body of knowledge that can be extremely valuable to communication systems designers if criteria for the use of error control coding can be developed the work

included an analysis of channel statistics that leads to a computer program designed to choose an optimum error control technique from standard channel statistics and data transmission parameters variable length variable redundancy codes and their applications were studied comparisons of block and recurrent codes were made in addition a study was made of error propagation in recurrent codes a cyclic decoding procedure for the familiar bose chaudhuri-hocquenghem code was developed comparisons were made between forward error correction codes and error detection codes with feedback and retransmission with data throughput rate the criterion for comparison finally a technique for combining error detection with message synchronization is described author

error control coding from theory to practice provides a concise introduction to basic coding techniques and their application the fundamental concepts of coding theory are explained using simple examples with minimum use of complex mathematical tools the selection of appropriate codes and the design of decoders are discussed bridging the gap between digital communications and information theory this accessible approach will appeal to students and practising engineers alike the clear presentation and practical emphasis make this book an excellent tool for both communications and electronic engineering students practitioners new to the field will find this text an essential guide to coding features include end of chapter problems to test and develop the readers understanding of the most popular codes and decoding methods finite field arithmetic and algebraic decoding methods for bch and reed solomon codes detailed coverage of viterbi decoding and related implementation issues turbo codes and related code types including gallager codes and turbo product codes practical examples of map and sova decoding for turbo codes

this textbook provides a firm foundation for those studying the field of error control codes giving step by step instruction on this complex topic beginning with single parity code checks and repetition codes through these basic error control mechanisms the fundamental principles of error detection and correction minimum distance and error control limits are considered with the use of detailed examples it guides students from basic error control codes through linear codes cyclic codes linear feedback shift registers vector fields galois fields bch codes and convolutional codes there are many detailed examples throughout the book to illustrate the principles and complex mathematical proofs are omitted where possible to keep the text concise and easy to follow

the bulk of the theory on error control codes has been developed under the fault assumption of random symmetric errors where 1 0 and 0 1 errors are equally likely in the past few years several applications have emerged in which the observed errors are highly asymmetric this has prompted the study of codes that offer a combination of symmetric and asymmetric error control capabilities this research is a part of this ongoing study the main results of the research are listed below 1 new upper bounds on t unordered codes exact bounds are established in some cases 2 a new method for constructing constant weight distance four codes that gives the best known bounds in several cases 3 a new

method for constructing single asymmetric error correcting codes the method establishes several new lower bounds 4 a construction for symmetric error correcting code the code is suited for a photon channel and other highly asymmetric channels because it has far fewer 1 s than 0 s the code uses one extra bit of redundancy over the bch code in almost all cases and it is relatively easy to encode and decode 5 a new construction for systematic double asymmetric error correcting code the resulting code is easier to decode than the bch code and is optimal in several cases the code has fewer 1 s than 0 s 6 a new construction for double symmetric error correcting linear code the resulting code is easier to decode than the bch code and is optimal in several cases 7 a new construction for linear codes the construction yields best known codes in many cases

this book provides thorough coverage of error correcting techniques it includes essential basic concepts and the latest advances on key topics in design implementation and optimization of hardware software systems for error correction the book s chapters are written by internationally recognized experts in this field topics include evolution of error correction techniques industrial user needs architectures and design approaches for the most advanced error correcting codes polar codes non binary ldpc product codes etc this book provides access to recent results and is suitable for graduate students and researchers of mathematics computer science and engineering examines how to optimize the architecture of hardware design for error correcting codes presents error correction codes from theory to optimized architecture for the current and the next generation standards provides coverage of industrial user needs advanced error correcting techniques advanced hardware design for error correcting codes includes a foreword by claude berrou

the art of error correcting coding provides a comprehensive coverage of the basic techniques of error concealment it addresses the need for selecting implementing and simulating algorithms for the encoding and decoding of codes used for error correction and detection this practical approach uses simple and easy to follow numerical examples to describe the basic concepts of a particular coding or decoding scheme basic analysis tools are provided throughout to help in the assessment of the error performance block and convolutional codes of a particular error correcting coding ecc scheme for a selection of the basic channel models provides a complete treatment of important decoding algorithms including errors and erasures decoding of bch and reed solomon codes for any set of consecutive zeros and any length describes viterbi decoding and the key implementation issues includes soft output decoding algorithms map log map max log map belief propagation and ordered statistics discusses new reliability based algorithms such as gmd and the chase algorithm with soft outputs examines turbo codes both serially and parallel concatenated as well as low density parity check ldpc codes and their iterative decoders features a companion website providing computer programs written in c language to help understanding and implementing basic ecc techniques this volume provides an indispensable tool for understanding and applying ecc techniques in transmission and storage of digital

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