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Channel Coding Theory  
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Read Free Channel Coding

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This book provides a comprehensive overview of the subject of channel coding. It starts with a description of information theory, focusing on the quantitative

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measurement of information  
and introducing two fundamental  
theorems on source and channel  
coding. The basics of channel  
coding in two chapters, block codes  
and convolutional codes, are then  
discussed, and for these the

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authors introduce weighted input and output decoding algorithms and recursive systematic convolutional codes, which are used in the rest of the book. Trellis coded modulations, which have their primary applications in high

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spectral efficiency transmissions, are then covered, before the discussion moves on to an advanced coding technique called turbo coding. These codes, invented in the 1990s by C. Berrou and A. Glavieux, show exceptional

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performance. The differences between convolutional turbocodes and block turbocodes are outlined, and for each family, the authors present the coding and decoding techniques, together with their performances. The book

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concludes with a chapter on the implementation of turbocodes in circuits. As such, anyone involved in the areas of channel coding and error correcting coding will find this book to be of invaluable assistance.

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It has long been recognized that there are fascinating connections between coding theory, cryptology, and combinatorics.

Therefore it seemed desirable to us to organize a conference that brings together experts from these



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three areas for a fruitful exchange of ideas. We decided on a venue in the Huang Shan (Yellow Mountain) region, one of the most scenic areas of China, so as to provide the additional inducement of an attractive location. The conference

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was planned for June 2003 with  
the official title Workshop on  
Coding, Cryptography and Combi  
natorics (CCC 2003). Those who  
are familiar with events in East  
Asia in the first half of 2003 can  
guess what happened in the end,

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namely the conference had to be cancelled in the interest of the health of the participants. The SARS epidemic posed too serious a threat. At the time of the cancellation, the organization of the conference was at an advanced

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stage: all invited speakers had been selected and all abstracts of contributed talks had been screened by the program committee. Thus, it was decided to call on all invited speakers and presenters of accepted contributed

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talks to submit their manuscripts for publication in the present volume. Altogether, 39 submissions were received and subjected to another round of refereeing. After careful scrutiny, 28 papers were accepted for publication.

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This is the revised edition of Berlekamp's famous book, 'Algebraic Coding Theory', originally published in 1968, wherein he introduced several algorithms which have subsequently dominated

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engineering practice in this field. One of these is an algorithm for decoding Reed-Solomon and Bose-Chaudhuri-Hocquenghem codes that subsequently became known as the Berlekamp-Massey Algorithm. Another is the

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Berlekamp algorithm for factoring  
polynomials over finite fields,  
whose later extensions and  
embellishments became widely  
used in symbolic manipulation  
systems. Other novel algorithms  
improved the basic methods for



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doing various arithmetic operations in finite fields of characteristic two. Other major research contributions in this book included a new class of Lee metric codes, and precise asymptotic results on the number of

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information symbols in long binary BCH codes. Selected chapters of the book became a standard graduate textbook. Both practicing engineers and scholars will find this book to be of great value.

Channel Coding in the Presence of

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Side Information reviews the concepts and methods of communication systems equipped with side information both from the theoretical and practical points of view. It is a comprehensive review that gives the reader an

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insightful introduction to one of  
the most important topics in  
modern communications systems.  
Error Correction Coding  
List Decoding of Error-Correcting  
Codes  
Channel Coding

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An Algorithmic Approach  
Channel Coding: Theory,  
Algorithms, and Applications

An unparalleled learning tool and  
guide to error correction coding  
Error correction coding techniques  
allow the detection and correction of

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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

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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

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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



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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

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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

Read Free Channel Coding Theory Algorithms And Applications Academic Press Library In Le And Wireless Communications 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

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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

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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

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benefit electrical and computer  
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engineers, mathematicians, students,  
researchers, and scientists.

oW should coded communication be  
approached? Is it about prob H  
ability theorems and bounds, or  
about algorithms and structures? The

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traditional course in information theory and coding teaches these together in one course in which the Shannon theory, a probabilistic theory of information, dominates. The theory's predictions and bounds to performance are valuable to the

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coding engineer, but coding today is mostly about structures and algorithms and their size, speed and error performance. While coding has a theoretical basis, it has a practical side as well, an engineering side in which costs and benefits matter. It is



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safe to say that most of the recent advances in information theory and coding are in the engineering of coding. These thoughts motivate the present text book: A coded communication book based on methods and algorithms, with

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information theory in a necessary but supporting role. There has been much recent progress in coding, both in the theory and the practice, and these pages report many new advances. Chapter 2 covers traditional source coding, but also

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the coding of real one-dimensional sources like speech and new techniques like vector quantization. Chapter 4 is a unified treatment of trellis codes, beginning with binary convolutional codes and passing to the new trellis modulation codes.

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This book gives a review of the principles, methods and techniques of important and emerging research topics and technologies in Channel Coding, including theory, algorithms, and applications. Edited by leading people in the field who,

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through their reputation, have been  
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able to commission experts to write

Communications  
on a particular topic. With this

reference source you will: Quickly  
grasp a new area of research

Understand the underlying principles  
of a topic and its applications

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Ascertain how a topic relates to other areas and learn of the research issues yet to be resolved Quick tutorial reviews of important and emerging topics of research in Channel Coding Presents core principles in Channel Coding theory

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and shows their applications  
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Reference content on core  
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principles, technologies, algorithms  
and applications Comprehensive  
references to journal articles and  
other literature on which to build  
further, more specific and detailed

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knowledge

A concise, easy-to-read guide,  
introducing beginners to the  
engineering background of modern  
communication systems, from  
mobile phones to data storage.

Assuming only basic knowledge of



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high-school mathematics and  
including many practical examples  
and exercises to aid understanding,  
this is ideal for anyone who needs a  
quick introduction to the subject.  
Part I of Fundamentals of Source  
and Video Coding

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Classical and Modern  
A First Course

Mathematical Methods and  
Algorithms

Introduction to Coding Theory

Distributed source coding is one of  
the key enablers for efficient

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cooperative communication. The potential applications range from wireless sensor networks, ad-hoc networks, and surveillance networks, to robust low-complexity video coding, stereo/Multiview video coding, HDTV, hyper-

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spectral and multispectral imaging, and biometrics. The book is divided into three sections: theory, algorithms, and applications. Part one covers the background of information theory with an emphasis on DSC; part two

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discusses designs of algorithmic solutions for DSC problems, covering the three most important DSC problems: Slepian-Wolf, Wyner-Ziv, and MT source coding; and part three is dedicated to a variety of potential DSC

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applications. Key features: Clear explanation of distributed source coding theory and algorithms including both lossless and lossy designs. Rich applications of distributed source coding, which covers multimedia communication

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and data security applications. Self-contained content for beginners from basic information theory to practical code implementation. The book provides fundamental knowledge for engineers and computer scientists to access the

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topic of distributed source coding.  
It is also suitable for senior  
undergraduate and first year  
graduate students in electrical  
engineering; computer  
engineering; signal processing;  
image/video processing; and



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information theory and  
communications.

Books on information theory and coding have proliferated over the last few years, but few succeed in covering the fundamentals without losing students in mathematical

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abstraction. Even fewer build the essential theoretical framework when presenting algorithms and implementation details of modern coding systems. Without abandoning the theoret

One of the most important key

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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

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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,

Read Free Channel Coding Theory Algorithms And Applications Academic Press Library In Line And Wireless Communications 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

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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

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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

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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



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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

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industry who want to know more  
about the theoretical basics of  
coding theory and their application  
in currently relevant  
communication systems  
Boolean functions are essential to  
systems for secure and reliable

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communication. This comprehensive survey of Boolean functions for cryptography and coding covers the whole domain and all important results, building on the author's influential articles with additional topics and recent

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results. A useful resource for researchers and graduate students, the book balances detailed discussions of properties and parameters with examples of various types of cryptographic attacks that motivate the

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consideration of these parameters. It provides all the necessary background on mathematics, cryptography, and coding, and an overview on recent applications, such as side channel attacks on smart cards, cloud computing

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through fully homomorphic encryption, and local pseudo-random generators. The result is a complete and accessible text on the state of the art in single and multiple output Boolean functions that illustrates the interaction

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between mathematics, computer  
science, and telecommunications.

Coding Theory

Digital Communications 1

Channel Codes

Source Coding

Coding for Channels with

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Feedback

" While multiple-access  
communication dates back to  
systems invented in the 1870s to  
transmit simultaneous data  
through a single wire, the  
foundation of the discipline now



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known as multiuser information theory was laid in 1961, when Claude E. Shannon published his paper on two-way channels. Since then, multiuser information theory has been an extremely active research area, and has

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seen a large number of  
fundamental contributions,  
covering, besides the two-way  
channel studied in, multiple  
access, interference, broadcast,  
and wiretap channels. However,  
several key canonical problems

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have defied many efforts. This book brings together leading experts working in the fields of information theory, coding theory, multiple user communications, discrete mathematics, etc., who survey

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recent and general results on multiple-access channels (rate regions, rate splitting, etc.), and give an overview of the problems of current CDMA solutions (fading channels, multi-user detection, multiple-antenna

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part, multiple-access techniques are discussed and the third part of this volume covers coding techniques. "

This book discusses the latest channel coding techniques, MIMO systems, and 5G channel

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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

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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



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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-

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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

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advanced and current concepts  
of coding theory.

This book provides a  
comprehensive explanation of  
forward error correction, which is  
a vital part of communication  
systems. The book is written in

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such a way to make the subject  
easy and understandable for the  
reader. The book starts with a  
review of linear algebra to  
provide a basis for the text. The  
author then goes on to cover  
linear block codes, syndrome

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error correction, cyclic codes,  
Galois fields, BCH codes, Reed  
Solomon codes, and  
convolutional codes. Examples  
are provided throughout the text.  
Provides a comprehensive  
treatment of forward error

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correction Includes examples through the book, which are solved in steps, making them easier to understand Ideal for researchers, professionals and students.

The book discusses modern

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channel coding techniques for wireless communications such as turbo codes, low parity check codes (LDPC), space-time coding, Reed Solomon (RS) codes and convolutional codes. Many illustrative examples are

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included in each chapter for easy understanding of the coding techniques. The text is integrated with MATLAB-based programs to enhance the understanding of the subject's underlying theories. It includes current



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topics of increasing importance  
such as turbo codes, LDPC  
codes, LT codes, Raptor codes  
and space-time coding in detail,  
in addition to the traditional  
codes such as cyclic codes, BCH  
and RS codes and convolutional

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codes. MIMO communications is a multiple antenna technology, which is an effective method for high-speed or high-reliability wireless communications. PC-based MATLAB m-files for the illustrative examples are included

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and also provided on the accompanying CD, which will help students and researchers involved in advanced and current concepts in coding theory.

Channel coding, the core of digital communication and data

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storage, has undergone a major revolution as a result of the rapid growth of mobile and wireless communications. The book is divided into 11 chapters.

Assuming no prior knowledge in the field of channel coding, the

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opening chapters (1 - 2) begin with basic theory and discuss how to improve the performance of wireless communication channels using channel coding. Chapters 3 and 4 introduce Galois fields and present

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detailed coverage of BCH codes  
and Reed-Solomon codes.

Chapters 5–7 introduce the  
family of convolutional codes,  
hard and soft-decision Viterbi  
algorithms, turbo codes, BCJR  
algorithm for turbo decoding and

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studies trellis coded modulation (TCM), turbo trellis coded modulation (TTCM), bit-interleaved coded modulation (BICM) as well as iterative BICM (BICM-ID) and compares them under various channel

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conditions. Chapters 8 and 9 focus on low-density parity-check (LDPC) codes, LT codes and Raptor codes. Chapters 10 and 11 discuss MIMO systems and space-time (ST) coding.

Theory and Practice



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Multiple Access Channels  
Source and Channel Coding  
From Theory to Turbocodes  
Selected Topics in Information  
and Coding Theory  
**Emphasizes source coding  
techniques that have**

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**become relevant for  
video coding in recent  
years. For illustrating  
the concepts and  
efficiency of the basic  
sources coding  
techniques, the authors**

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provide numerous  
examples and  
experimental results for  
simple model sources.  
Covers the fundamental  
principles of space-time  
coding for wireless

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**communications over MIMO  
channels.**

**This 2006 book  
introduces the  
theoretical foundations  
of error-correcting  
codes for senior-**

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**undergraduate to  
graduate students.**

**Having trouble deciding  
which coding scheme to  
employ, how to design a  
new scheme, or how to  
improve an existing**

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system? This summary of  
the state-of-the-art in  
iterative coding makes  
this decision more  
straightforward. With  
emphasis on the  
underlying theory,

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**techniques to analyse  
and design practical  
iterative coding systems  
are presented. Using  
Gallager's original  
ensemble of LDPC codes,  
the basic concepts are**

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**extended for several  
general codes, including  
the practically  
important class of turbo  
codes. The simplicity of  
the binary erasure  
channel is exploited to**



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**develop analytical  
techniques and  
intuition, which are  
then applied to general  
channel models. A  
chapter on factor graphs  
helps to unify the**

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**important topics of  
information theory,  
coding and communication  
theory. Covering the  
most recent advances,  
this text is ideal for  
graduate students in**

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**electrical engineering  
and computer science,  
and practitioners.**

**Additional resources,  
including instructor's  
solutions and figures,  
available online: [www.ca](http://www.ca)**

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**Modern Coding Theory  
Channel Coding for  
Telecommunications  
EXIT-Chart-Aided Near-  
Capacity Designs for**

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**Wireless Channels  
The Art of Error  
Correcting Coding  
Turbo Coding, Turbo  
Equalisation and Space-  
Time Coding**

This book clearly describes the leading

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techniques for channel coding. An advanced tutorial greatly improves the reader's understanding of the material. Rigorous analytical and theoretical examples are provided along with sample problems and solutions. The latest research findings on new techniques in channel coding are also included.

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This book is offers a comprehensive overview of information theory and error control coding, using a different approach than in existed literature. The chapters are organized according to the Shannon system model, where one block affects the others. A relatively brief theoretical introduction is provided at the beginning

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of every chapter, including a few additional examples and explanations, but without any proofs. And a short overview of some aspects of abstract algebra is given at the end of the corresponding chapters. The characteristic complex examples with a lot of illustrations and tables are chosen to provide detailed



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insights into the nature of the problem. Some limiting cases are presented to illustrate the connections with the theoretical bounds. The numerical values are carefully selected to provide in-depth explanations of the described algorithms. Although the examples in the different chapters can be considered separately,

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they are mutually connected and the conclusions for one considered problem relate to the others in the book.

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,

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convolutional codes and concatenated codes. Library In Le And Wireless

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This monograph is a thoroughly revised and extended version of the author's PhD thesis, which was selected as the winning thesis of the 2002 ACM Doctoral Dissertation Competition. Venkatesan Guruswami did his PhD work at the MIT

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with Madhu Sudan as thesis adviser.

Starting with the seminal work of Shannon

and Hamming, coding theory has

generated a rich theory of error-

correcting codes. This theory has

traditionally gone hand in hand with the

algorithmic theory of decoding that

tackles the problem of recovering from the

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transmission errors efficiently. This book presents some spectacular new results in the area of decoding algorithms for error-correcting codes. Specifically, it shows how the notion of list-decoding can be applied to recover from far more errors, for a wide variety of error-correcting codes, than achievable before The style of

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the exposition is crisp and the enormous amount of information on combinatorial results, polynomial time list decoding algorithms, and applications is presented in well structured form.

Distributed Source Coding

Fundamentals of Information Theory and  
Coding Design

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Information Theory and Network Coding  
Introduction to Information Theory and  
Data Compression, Second Edition

**Coding Theory Algorithms,  
Architectures and  
Applications John Wiley & Sons**

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**Coding for Channels with  
Feedback presents both  
algorithms for feedback coding  
and performance analyses of  
these algorithms, including  
analyses of perhaps the most  
important performance**



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**criterion: computational complexity. The algorithms are developed within a single framework, termed the compressed-error-cancellation framework, where data are sent via a sequence of**

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**messages: the first message  
contains the original data;  
each subsequent message  
contains a source-coded  
description of the channel  
distortions introduced on the  
message preceding it. Coding**

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**for Channels with Feedback  
provides an easily understood  
and flexible framework for  
deriving low-complexity,  
practical solutions to a wide  
variety of feedback  
communication problems. It is**

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**shown that the compressed-  
error-cancellation framework  
leads to coding schemes with  
the lowest possible asymptotic  
order of growth of  
computations and can be  
applied to discrete memoryless**

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**channels, finite state channels,  
channels with memory,  
unknown channels, and  
multiple-access channels, all  
with complete noiseless  
feedback, as well as to  
channels with partial and noisy**

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**feedback. This framework  
leads to coding strategies that  
have linear complexity and are  
capacity achieving, and  
illustrates the intimate  
connection between source  
coding theory and channel**

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**coding theory. Coding for Channels with Feedback is an excellent reference for researchers and communication engineers in the field of information theory, and can be used for advanced**

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courses on the topic.

**Iterative algorithms are now widely used in all areas of signal processing and digital communications. In modern communication systems, iterative algorithms are**



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**notably used for decoding low-density parity-check (LDPC) codes, a popular class of error-correction codes known to have exceptional error-rate performance under iterative decoding. In a more recent**

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**field known as compressed sensing, iterative algorithms are used as a method of reconstruction to recover a sparse signal from a linear set of measurements. This work primarily deals with the**

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**development of low-complexity  
iterative algorithms for the two  
aforementioned fields, namely,  
the design of low-complexity  
decoding algorithms for LDPC  
codes, and the development  
and analysis of a low**

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**complexity reconstruction  
algorithm for compressed  
sensing. In the first part of this  
dissertation, we focus on the  
decoding algorithms for LDPC  
codes. It is now well known  
that LDPC codes suffer from**

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**an error floor phenomenon in spite of their exceptional performance. This phenomenon originates from the failures of traditional iterative decoders, like belief propagation (BP), on certain**

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**low-noise configurations. Recently, a novel class of decoders, called finite alphabet iterative decoders (FAIDs), were proposed with the capability of surpassing BP in the error floor region at a**

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**much lower complexity. We show that numerous FAIDs can be designed, and among them only a few will have the ability of surpassing traditional decoders in the error floor region. In this work, we focus**

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**on the problem of the selection  
of good FAIDs for column-  
weight-three codes over the  
binary symmetric channel.  
Traditional methods for  
decoder selection use  
asymptotic techniques such as**



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**the density evolution method,  
but the designed decoders do  
not guarantee good  
performance for finite-length  
codes especially in the error  
floor region. Instead we  
propose a methodology to**

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**identify FAIDs with good error-rate performance in the error floor. This methodology relies on the knowledge of potentially harmful topologies that could be present in a code. The selection method**

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**uses the concept of noisy trapping set. Numerical results are provided to show that FAIDs selected based on our methodology outperform BP in the error floor on a wide range of codes. Moreover first results**

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**on column-weight-four codes demonstrate the potential of such decoders on codes which are more used in practice, for example in storage systems. In the second part of this dissertation, we address the**

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**area of iterative reconstruction  
algorithms for compressed  
sensing. This field has  
attracted a lot of attention  
since Donoho's seminal work  
due to the promise of sampling  
a sparse signal with less**

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**samples than the Nyquist theorem would suggest.**

**Iterative algorithms have been proposed for compressed sensing in order to tackle the complexity of the optimal reconstruction methods which**

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**notably use linear programming. In this work, we modify and analyze a low complexity reconstruction algorithm that we refer to as the interval-passing algorithm (IPA) which uses sparse**

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**matrices as measurement matrices. Similar to what has been done for decoding algorithms in the area of coding theory, we analyze the failures of the IPA and link them to the stopping sets of**



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**the binary representation of  
the sparse measurement  
matrices used. The**

**performance of the IPA makes  
it a good trade-off between the  
complex  $l_1$ -minimization  
reconstruction and the very**

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**simple verification decoding.**

**The measurement process has also a lower complexity as we use sparse measurement matrices. Comparison with another type of message-passing algorithm, called**

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**approximate message-passing,  
show the IPA can have superior  
performance with lower  
complexity. We also  
demonstrate that the IPA can  
have practical applications  
especially in spectroscopy.**

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**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**

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**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**

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**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.**

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**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**

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**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**



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**resource for students and  
practitioners alike.**

**Codes and turbo codes  
Channel Coding in  
Communication Networks  
Channel Coding Techniques  
for Wireless Communications**

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**Channel Coding in the  
Presence of Side Information**  
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*This book provides the  
first comprehensive and  
easy-to-read discussion of  
joint source-channel*

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*encoding and decoding for  
source signals with  
continuous amplitudes. It  
is a state-of-the-art  
presentation of this  
exciting, thriving field  
of research, making*

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*pioneering contributions  
to the new concept of  
source-adaptive  
modulation. The book starts  
with the basic theory and  
the motivation for a joint  
realization of source and*

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*channel coding.*

*Specialized chapters deal  
with practically relevant  
scenarios such as  
iterative source-channel  
decoding and its  
optimization for a given*

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encoder, and also improved  
encoder designs by channel-  
adaptive quantization or  
source-adaptive  
modulation. Although

Information Theory is not  
the main topic of the book

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? in fact, the concept of  
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joint source-channel  
coding is contradictory to  
the classical system  
design motivated by a  
questionable practical  
interpretation of the

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*separation theorem ? this  
theory still provides the  
ultimate performance  
limits for any practical  
system, whether it uses  
joint source-channel  
coding or not. Therefore,*



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*the theoretical limits are  
presented in a self-  
contained appendix, which  
is a useful reference also  
for those not directly  
interested in the main  
topic of this book.*

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*Building on the success of the first edition, which offered a practical introductory approach to the techniques of error concealment, this book, now fully revised and*

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*updated, provides a  
comprehensive treatment of  
the subject and includes a  
wealth of additional  
features. The Art of Error  
Correcting Coding, Second  
Edition explores*

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*intermediate and advanced  
level concepts as well as  
those which will appeal to  
the novice. All key topics  
are discussed, including  
Reed-Solomon codes,  
Viterbi decoding, soft-*

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*output decoding  
algorithms, MAP, log-MAP  
and MAX-log-MAP.*

*Reliability-based  
algorithms GMD and Chase  
are examined, as are turbo  
codes, both serially and*

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*parallel concatenated, as well as low-density parity-check (LDPC) codes and their iterative decoders.*

*Features additional problems at the end of each chapter and an*

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*instructor's solutions  
manual Updated companion  
website offers new C/C  
++programs and MATLAB  
scripts, to help with the  
understanding and  
implementation of basic*

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*ECC techniques Easy to  
follow examples illustrate  
the fundamental concepts  
of error correcting codes  
Basic analysis tools are  
provided throughout to  
help in the assessment of*



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*the error performance  
block and convolutional  
codes of a particular  
error correcting coding  
(ECC) scheme for a  
selection of the basic  
channel models This*

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*edition provides an  
essential resource to  
engineers, computer  
scientists and graduate  
students alike for  
understanding and applying  
ECC techniques in the*

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*transmission and storage  
of digital information.*

*Provides a tutorial on the  
basics of network coding  
theory. Divided into two  
parts, this book presents  
a unified framework for*

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*understanding the basic  
notions and fundamental  
results in network coding.  
It is aimed at students,  
researchers and  
practitioners working in  
networking research.*

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*The communication chain is constituted by a source and a recipient, separated by a transmission channel which may represent a portion of cable, an optical fiber, a radio*

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*channel, or a satellite  
link. Whatever the  
channel, the processing  
blocks implemented in the  
communication chain have  
the same foundation. This  
book aims to itemize. In*

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*this first volume, after  
having presented the base  
of the information theory,  
we will study the source  
coding techniques with and  
without loss. Then we  
analyze the correcting*

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*codes for block errors,  
convutional and  
concatenated used in  
current systems.*

*Information Theory and  
Coding - Solved Problems  
A Student's Guide to*



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*Coding and Information  
Theory, Algorithms and  
Applications  
Forward Error Correction  
Via Channel Coding  
Network Coding Theory*

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An effective blend of carefully explained theory and practical applications, this text imparts the fundamentals of both information theory and data compression. Although the two topics are related, this unique

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text allows either topic to be presented independently, and it was specifically designed so that the data compression section requires no prior knowledge of information theory. The treatment of

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information theory, while theoretical and abstract, is quite elementary, making this text less daunting than many others. After presenting the fundamental definitions and results of the theory, the

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authors then apply the theory to memoryless, discrete channels with zeroth-order, one-state sources. The chapters on data compression acquaint students with a myriad of lossless compression

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methods and then introduce two lossy compression methods. Students emerge from this study competent in a wide range of techniques. The authors' presentation is highly practical but includes some

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important proofs, either in the text or in the exercises, so instructors can, if they choose, place more emphasis on the mathematics. Introduction to Information Theory and Data Compression, Second Edition is

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ideally suited for an upper-level or graduate course for students in mathematics, engineering, and computer science. Features: Expanded discussion of the historical and theoretical basis of information



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theory that builds a firm,  
intuitive grasp of the subject  
Reorganization of theoretical  
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exercises, ranging from the  
routine to the more difficult,  
that reinforce students' ability

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to apply the definitions and  
results in specific situations.

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algorithm(s) of Gallager and  
Knuth Discussion of the  
information rate of a code and  
the trade-off between error

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correction and information rate  
Treatment of probabilistic finite  
state source automata,  
including basic results,  
examples, references, and  
exercises Octave and MATLAB  
image compression codes

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included in an appendix for use  
with the exercises and projects  
involving transform methods  
Supplementary materials,  
including software, available  
for download from the authors'  
Web site at [www.dms.auburn.e](http://www.dms.auburn.e)

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du/compression

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vision. The chapters in this comprehensive reference explore the latest developments, methods, approaches, and applications of coding theory in a wide variety of fields and

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endeavours. This book is compiled with a view to provide researchers, academicians, and readers with an in-depth discussion of the latest advances in this field. It consists of twelve

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chapters from academicians,  
practitioners, and researchers  
from different disciplines of  
life. All the chapters are  
authored by various  
researchers around the world  
covering the field of coding



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theory and image and video processing. This book mainly focusses on researchers who can do quality research in the area of coding theory and image and video processing and related fields. Each

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chapter is an independent research study, which will motivate young researchers to think about. These twelve chapters are presented in three sections and will be an eye-opener for all who

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systematic researchers in  
these fields.

Table of contents

This book is an evolution from  
my book A First Course in  
Information Theory published  
in 2002 when network coding

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was still at its infancy. The last few years have witnessed the rapid development of network coding into a research field of its own in information science. With its root in information theory, network coding has not

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only brought about a paradigm shift in network communications at large, but also had significant influence on such specific research fields as coding theory, networking, switching, wireless communication

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ns, distributed data storage, cryptography, and optimization theory  
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. While new applications of network coding keep emerging, the fundamental - sults that lay the foundation of the subject are more or less mature. One

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of the main goals of this book therefore is to present these results in a unifying and coherent manner. While the previous book focused only on information theory for discrete random variables, the current

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book contains two new chapters on information theory for continuous random variables, namely the chapter on differential entropy and the chapter on continuous-valued channels. With these topics



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included, the book becomes more comprehensive and is more suitable to be used as a textbook for a course in an electrical engineering department.

Low Complexity Iterative

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Algorithms in Channel Coding  
and Compressed Sensing  
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Information Theory, Inference  
and Learning Algorithms

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***Modern introduction to theory of coding***

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*and decoding with many exercises and  
examples.*

*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*

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*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*

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*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*

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*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*

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*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*



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*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*

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*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*

*The advent of wireless sensor technology  
and ad-hoc networks has made DSC a*

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*major field of interest. Edited and written by the leading players in the field, this book presents the latest theory, algorithms and applications, making it the definitive reference on DSC for systems designers and implementers, researchers, and graduate students. This book gives a clear understanding of the performance limits*

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*of distributed source coders for specific classes of sources and presents the design and application of practical algorithms for realistic scenarios. Material covered includes the use of standard channel codes, such as LDPC and Turbo codes, to DSC, and discussion of the suitability of compressed sensing for distributed*

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*compression of sparse signals. Extensive applications are presented and include distributed video coding, microphone arrays and securing biometric data. This book is a great resource covering the breadth and depth of distributed source coding that's appropriate for everyone from theoreticians to practitioners. –*

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*Richard Baraniuk, Rice University \*Clear explanation of the principles of distributed source coding (DSC), a technology that has applications in sensor networks, ad-hoc networks, and distributed wireless video systems for surveillance \*Edited and written by the leading players in the field, providing a*

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*complete and authoritative reference*

*\*Contains all the latest theory, practical  
algorithms for DSC design and the most  
recently developed applications*

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