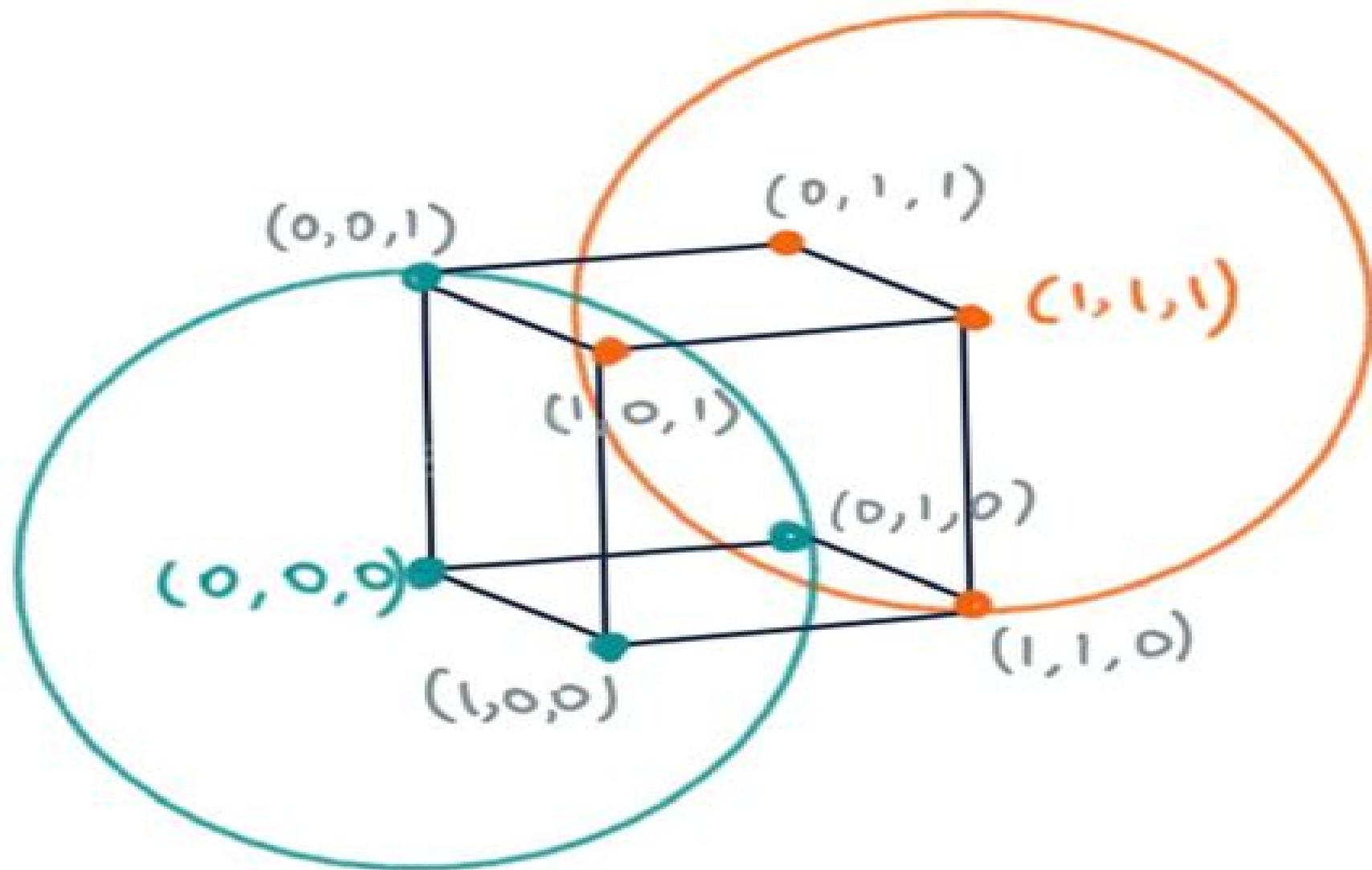


# ERROR-CORRECTING CODES

RADHIKA IYER - TEDDY ROCKS MATHS 2022 SHORTLIST



# Error Correcting Codes

**Jiyuan Zhang**



## Error Correcting Codes:

*Error-correcting Codes* William Wesley Peterson, E. J. Weldon, 1972 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 **An Introduction to Error Correcting Codes with Applications** Scott A. Vanstone, Paul C. van Oorschot, 2013-04-18 5 2 Rings and Ideals 148 5 3 Ideals and Cyclic Subspaces 152 5 4 Generator Matrices and Parity Check Matrices 159 5 5 Encoding Cyclic Codes 163 5 6 Syndromes and Simple Decoding Procedures 168 5 7 Burst Error Correcting 175 5 8 Finite Fields and Factoring  $x^n - 1$  over  $GF(q)$  181 5 9 Another Method for Factoring  $x^n - 1$  over  $GF(q)$  187 5 10 Exercises 193 Chapter 6 BCH Codes and Bounds for Cyclic Codes 6 1 Introduction 201 6 2 BCH Codes and the BCH Bound 205 6 3 Bounds for Cyclic Codes 210 6 4 Decoding BCH Codes 215 6 5 Linearized Polynomials and Finding Roots of Polynomials 224 6 6 Exercises 231 Chapter 7 Error Correction Techniques and Digital Audio Recording 7 1 Introduction 237 7 2 Reed Solomon Codes 237 7 3 Channel Erasures 240 7 4 BCH Decoding with Erasures 244 7 5 Interleaving 250 7 6 Error Correction and Digital Audio Recording 256 7 An Introduction to Error-correcting Codes Shu Lin, 1970 Codes Kodierung Telegrafie Kodierung Datendarstellung Bit Byte EDV **Error-correcting Codes** John Baylis, 2003 **A Course in Error-correcting Codes** Jørn Justesen, Tom Høholdt, 2004 This book is written as a text for a course aimed at advanced undergraduates Chapters cover the codes and decoding methods that are currently of most interest in research development and application They give a relatively brief presentation of the essential results emphasizing the interrelations between different methods and proofs of all important results A sequence of problems at the end of each chapter serves to review the results and give the student an appreciation of the concepts *A Commonsense Approach to the Theory of Error Correcting Codes* Benjamin Arazi, 1988 Teaching the theory of error correcting codes on an introductory level is a difficult task The theory which has immediate hardware applications also concerns highly abstract mathematical concepts This text explains the basic circuits in a refreshingly practical way that will appeal to undergraduate electrical engineering students as well as to engineers and technicians working in industry Arazi's truly commonsense approach provides a solid grounding in the subject explaining principles intuitively from a hardware perspective He fully covers error correction techniques from basic parity check and single error correction cyclic codes to burst error correcting codes and convolutional codes All this he presents before introducing Galois field theory the basic algebraic treatment and theoretical basis of the subject which usually appears in the opening chapters of standard textbooks One entire chapter is devoted to specific practical issues such as Reed Solomon codes used in compact disc equipment and maximum length sequences used in various fields of communications The basic circuits explained throughout the book are redrawn and analyzed from a theoretical point of view for readers who are interested in tackling the mathematics at a more advanced level Benjamin Arazi is an Associate Professor in the Department of Electrical and Computer Engineering at

the Ben Gurion University of the Negev His book is included in the Computer Systems Series edited by Herb Schwetman

**Advanced Hardware Design for Error Correcting Codes** Cyrille Chavet, Philippe Coussy, 2014-10-30 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 *Error Correcting Codes* D J. Baylis, 2018-05-11 Assuming little previous mathematical knowledge *Error Correcting Codes* provides a sound introduction to key areas of the subject Topics have been chosen for their importance and practical significance which Baylis demonstrates in a rigorous but gentle mathematical style Coverage includes optimal codes linear and non linear codes general techniques of decoding errors and erasures error detection syndrome decoding and much more *Error Correcting Codes* contains not only straight maths but also exercises on more investigational problem solving Chapters on number theory and polynomial algebra are included to support linear codes and cyclic codes and an extensive reminder of relevant topics in linear algebra is given Exercises are placed within the main body of the text to encourage active participation by the reader with comprehensive solutions provided *Error Correcting Codes* will appeal to undergraduate students in pure and applied mathematical fields software engineering communications engineering computer science and information technology and to organizations with substantial research and development in those areas **Foundations of Coding** Jiri Adamek, 2011-02-14 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 *A Short Course on Error Correcting Codes* Neil James Alexander Sloane, 1975 *A Short Course on Error Correcting Codes* N.J.A. Sloane, 2014-05-04 *Fundamentals of Classical and Modern Error-Correcting Codes* Shu Lin, Juane Li, 2021-12-09 Using easy to follow mathematics this textbook provides comprehensive coverage of block codes and techniques for reliable communications and data storage It covers major code designs and constructions from geometric algebraic and graph

theoretic points of view decoding algorithms error control additive white Gaussian noise AWGN and erasure and dataless recovery It simplifies a highly mathematical subject to a level that can be understood and applied with a minimum background in mathematics provides step by step explanation of all covered topics both fundamental and advanced and includes plenty of practical illustrative examples to assist understanding Numerous homework problems are included to strengthen student comprehension of new and abstract concepts and a solutions manual is available online for instructors Modern developments including polar codes are also covered An essential textbook for senior undergraduates and graduates taking introductory coding courses students taking advanced full year graduate coding courses and professionals working on coding for communications and data storage

**The theory of error-correcting codes** Florence Jessie MacWilliams, Neil James Alexander Sloane, 1977 [Introduction to the Theory of Error-correcting Codes](#) Vera Pless, 1982 Introduction to the Theory of Error Correcting Codes Third Edition is the ideal textbook for senior undergraduate and first year graduate courses on error correcting codes in mathematics computer science and electrical engineering

**Block Error-Correcting Codes** Sebastian Xambo-Descamps, 2012-12-06 Error correcting codes have been incorporated in numerous working communication and memory systems This book covers the mathematical aspects of the theory of block error correcting codes together in mutual reinforcement with computational discussions implementations and examples of all relevant concepts functions and algorithms This combined approach facilitates the reading and understanding of the subject The digital companion of the book is a non printable pdf document with hyperlinks The examples included in the book can be run with just a mouse click and modified and saved by users for their own purpose

**The Theory of Error-correcting Codes** F. J. Macwilliams, 1988 **Error Correcting Codes** Henry Berthold Mann, 1968 [Error Correcting Coding and Security for Data Networks](#) Grigorii Kabatiansky, Evgenii Krouk, Sergei Semenov, 2005-10-31 Error correcting coding is often analyzed in terms of its application to the separate levels within the data network in isolation from each other In this fresh approach the authors consider the data network as a superchannel a multi layered entity which allows error correcting coding to be evaluated as it is applied to a number of network layers as a whole By exposing the problems of applying error correcting coding in data networks and by discussing coding theory and its applications this original technique shows how to correct errors in the network through joint coding at different network layers Discusses the problem of reconciling coding applied to different layers using a superchannel approach Includes thorough coverage of all the key codes linear block codes Hamming BCH and Reed Solomon codes LDPC codes decoding as well as convolutional turbo and iterative coding Considers new areas of application of error correcting codes such as transport coding code based cryptosystems and coding for image compression Demonstrates how to use error correcting coding to control such important data characteristics as mean message delay Provides theoretical explanations backed up by numerous real world examples and practical recommendations Features a companion website containing additional research results including new constructions of LDPC codes joint error

control coding and synchronization Reed Muller codes and their list decoding By progressing from theory through to practical problem solving this resource contains invaluable advice for researchers postgraduate students engineers and computer scientists interested in data communications and applications of coding theory **The Art of Error Correcting Coding** Robert H. Morelos-Zaragoza,2006-07-11 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 updated provides a comprehensive treatment of the subject and includes a wealth of additional features The Art of Error Correcting Coding Second Edition explores 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 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 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 instructor s solutions manual Updated companion website offers new C C programs and MATLAB scripts to help with the understanding and implementation of basic 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 the error performance block and convolutional codes of a particular error correcting coding ECC scheme for a selection of the basic channel models This edition provides an essential resource to engineers computer scientists and graduate students alike for understanding and applying ECC techniques in the transmission and storage of digital information *Introduction to the Theory of Error-Correcting Codes* ,1984-02-01

## Whispering the Secrets of Language: An Emotional Quest through **Error Correcting Codes**

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