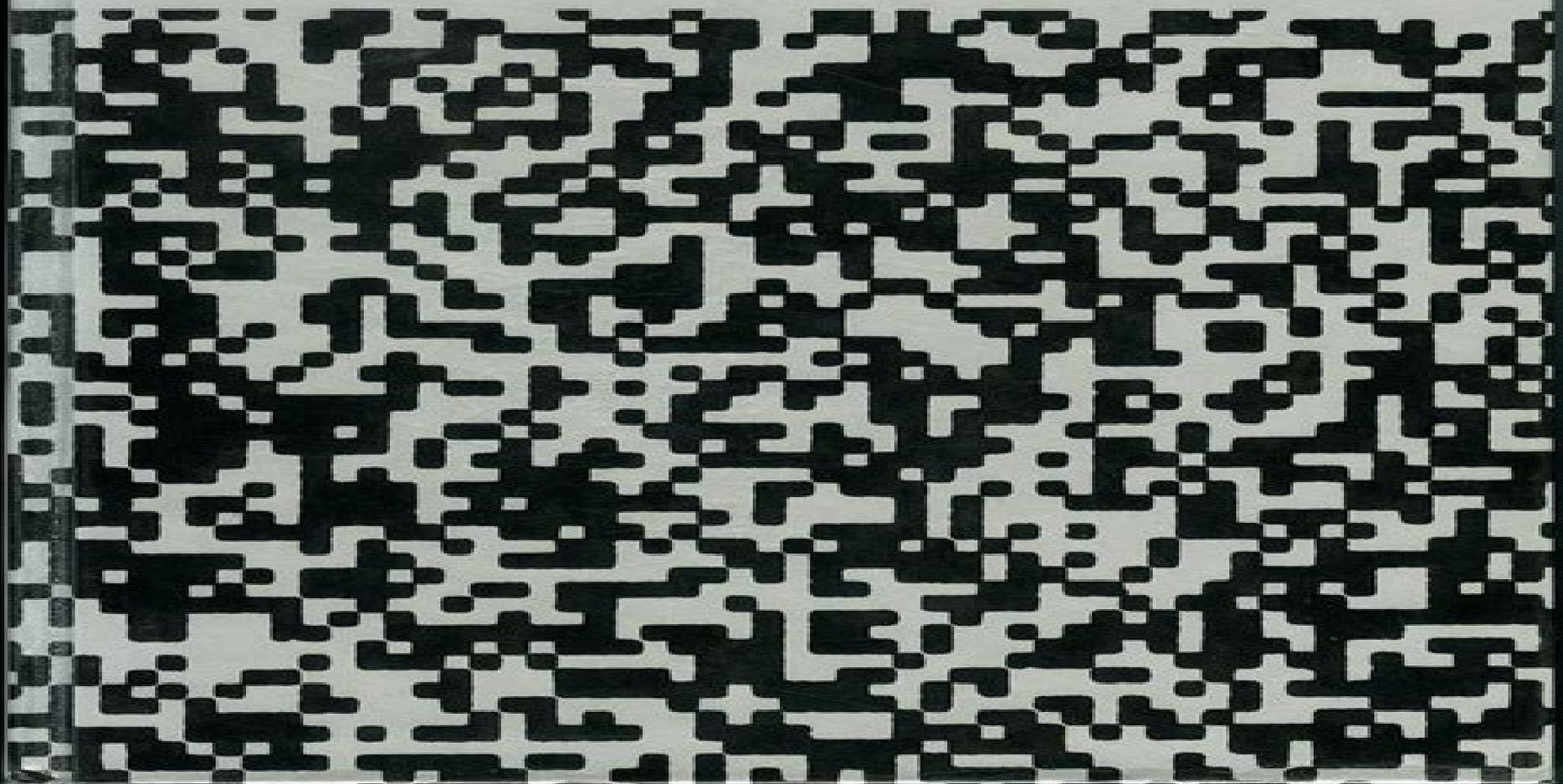


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# **Error-Correcting Codes and Finite Fields**

**OLIVER PRETZEL**



# Error Correcting Codes And Finite Fields

**Simeon Ball**



## **Error Correcting Codes And Finite Fields:**

Error-correcting Codes and Finite Fields Oliver Pretzel,2023 Starting with the elementary ideas of parity check codes this work takes the reader via BCH and Reed Solomon codes all the way to the geometric Goppa codes The necessary mathematics is developed in parallel with the applications *Error-correcting Codes and Finite Fields* Oliver Pretzel,1992 Starting with the elementary ideas of parity check codes this work takes the reader via BCH and Reed Solomon codes all the way to the geometric Goppa codes The necessary mathematics is developed in parallel with the applications *The Theory of Error-correcting Codes* Florence Jessie MacWilliams,Neil James Alexander Sloane,1977 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 **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 Finite Fields in Algebraic Coding Theory Anne Lind Reese,1973 **A Course in Algebraic Error-Correcting Codes** Simeon Ball,2020-05-08 This textbook provides a rigorous mathematical perspective on error correcting codes starting with the basics and progressing through to the state of the art Algebraic combinatorial and geometric approaches to coding theory are adopted with the aim of highlighting how coding can have an important real world impact Because it carefully balances both theory and applications this book will be an indispensable resource for readers seeking a timely treatment of error correcting codes Early chapters cover fundamental concepts introducing Shannon's theorem asymptotically good codes and linear codes The book then goes on to cover other types of codes including chapters on cyclic codes maximum distance separable codes LDPC codes p-adic codes amongst others Those undertaking independent study will appreciate the helpful exercises with selected solutions A Course in Algebraic Error Correcting Codes suits an interdisciplinary audience at the Masters level including students of mathematics engineering physics and computer science Advanced undergraduates will find this a useful resource as well An

understanding of linear algebra is assumed      *Application of Fourier Transform Over Finite Fields to Error-correcting Codes*

David Mun-Hein Choy,1976      **Facets of Algebraic Geometry: Volume 1** Paolo Aluffi,David Anderson,Milena

Hering,Mircea Mustață,Sam Payne,2022-04-07 Written to honor the 80th birthday of William Fulton the articles collected in this volume the first of a pair present substantial contributions to algebraic geometry and related fields with an emphasis on combinatorial algebraic geometry and intersection theory Featured topics include commutative algebra moduli spaces quantum cohomology representation theory Schubert calculus and toric and tropical geometry The range of these contributions is a testament to the breadth and depth of Fulton s mathematical influence The authors are all internationally recognized experts and include well established researchers as well as rising stars of a new generation of mathematicians The text aims to stimulate progress and provide inspiration to graduate students and researchers in the field      Application

of Fourier Transform Over Finite Fields to Error-correcting Codes David Mun-Hien Choy,1974 BCH code is one of the most powerful and the most extensively studied classes of algebraic error correcting codes Unfortunately it was found that its performance in error correction deteriorates as its length increases In this report a class of algebraic linear codes is proposed based on the structure of Fourier Transform over finite fields This class of codes includes the BCH codes and Srivastava codes as proper subclasses Several constructive bounds on the minimum distance of these codes are derived and are shown to be achievable using Berlekamp s iterative decoding algorithm or using Goppa s method based on divided difference A new distance bound is also obtained for a group of binary Srivastava codes Modified author abstract

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      *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      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

**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

Applied Algebra, Algebraic Algorithms, and Error-correcting Codes,1997

Multi Twisted Codes Over Finite Fields and Their Generalizations Chauhan Varsha,2022-11-22 Nowadays error correcting codes are widely used in communication systems re turning pictures from deep space designing registration numbers and storage of data in memory systems An important family of error correcting codes is that of linear codes which contain many well known codes such as Hamming codes Hadamard codes cyclic codes and quasi cyclic codes Recently Aydin and Halilovic 5 introduced and studied multi twisted MT codes over the nite eld  $F_q$  whose block lengths are coprime to  $q$  These codes are generalizations of well known classes of linear codes such as constacyclic codes and generalized quasi cyclic codes hav ing rich algebraic structures and containing record breaker codes In the same work they obtained subcodes of MT codes with best known parameters  $33\ 12\ 12$  over  $F_3$   $53\ 18\ 21$  over  $F_5$   $23\ 7\ 13$  over  $F_7$  and optimal parameters  $54\ 4\ 44$  over  $F_7$  Apart from this they proved that the code parameters  $53\ 18\ 21$  over  $F_5$  and  $33\ 12\ 12$  over  $F_3$  can not be attained by constacyclic and quasi cyclic codes which suggests that this larger class of MT codes is more promising to nd codes with better parameters than the current best known linear codes

Introduction to the Theory of Error-correcting Codes Vera Pless,1989 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 Correcting Codes** John Baylis,2017-07-27 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

**Introduction to Modern Algebra and Its Applications** Nadiya Gubareni, 2021-06-23

The book provides an introduction to modern abstract algebra and its applications It covers all major topics of classical theory of numbers groups rings fields and finite dimensional algebras The book also provides interesting and important modern applications in such subjects as Cryptography Coding Theory Computer Science and Physics In particular it considers algorithm RSA secret sharing algorithms Diffie Hellman Scheme and ElGamal cryptosystem based on discrete logarithm problem It also presents Buchberger s algorithm which is one of the important algorithms for constructing Gr bner basis Key Features Covers all major topics of classical theory of modern abstract algebra such as groups rings and fields and their applications In addition it provides the introduction to the number theory theory of finite fields finite dimensional algebras and their applications Provides interesting and important modern applications in such subjects as Cryptography Coding Theory Computer Science and Physics Presents numerous examples illustrating the theory and applications It is also filled with a number of exercises of various difficulty Describes in detail the construction of the Cayley Dickson construction for finite dimensional algebras in particular algebras of quaternions and octonions and gives their applications in the number theory and computer graphics

High-speed VLSI Architectures for Error-correcting Codes and Cryptosystems Xinmiao Zhang, 2005

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