

# **From Error-Correcting Codes Through Sphere Packings to Simple Groups**

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# From Errorcorrecting Codes Through Sphere Packings To Simple Groups

**G. Cohen, I. Honkala, S. Litsyn, A.  
Lobstein**



## **From Errorcorrecting Codes Through Sphere Packings To Simple Groups:**

**From Error-correcting Codes Through Sphere Packings to Simple Groups** Thomas M. Thompson, 1983 This book traces a remarkable path of mathematical connections through seemingly disparate topics Frustrations with a 1940 s electro mechanical computer at a premier research laboratory begin this story Subsequent mathematical methods of encoding messages to ensure correctness when transmitted over noisy channels led to discoveries of extremely efficient lattice packings of equal radius balls especially in 24 dimensional space In turn this highly symmetric lattice with each point neighbouring exactly 196 560 other points suggested the possible presence of new simple groups as groups of symmetries Indeed new groups were found and are now part of the Enormous Theorem the classification of all simple groups whose entire proof runs to some 10 000 pages And these connections along with the fascinating history and the proof of the simplicity of one of those sporadic simple groups are presented at an undergraduate mathematical level Amazon com

**From Error-correcting Codes Through Sphere Packings to Simple Groups** Thomas M. Thompson (matematyka), 1983 **From Error-correcting Codes Through Sphere Packings to Simple Groups** Thomas Miller Thompson, 1979 **Introduction to Coding Theory** Jurgen Bierbrauer, 2018-10-03 Although its roots lie in information theory the applications of coding theory now extend to statistics cryptography and many areas of pure mathematics as well as pervading large parts of theoretical computer science from universal hashing to numerical integration Introduction to Coding Theory introduces the theory of error correcting codes in a thorough but gentle presentation Part I begins with basic concepts then builds from binary linear codes and Reed Solomon codes to universal hashing asymptotic results and 3 dimensional codes Part II emphasizes cyclic codes applications and the geometric description of codes The author takes a unique more natural approach to cyclic codes that is not couched in ring theory but by virtue of its simplicity leads to far reaching generalizations Throughout the book his discussions are packed with applications that include but reach well beyond data transmission with each one introduced as soon as the codes are developed Although designed as an undergraduate text with myriad exercises lists of key topics and chapter summaries Introduction to Coding Theory explores enough advanced topics to hold equal value as a graduate text and professional reference Mastering the contents of this book brings a complete understanding of the theory of cyclic codes including their various applications and the Euclidean algorithm decoding of BCH codes and carries readers to the level of the most recent research **Selected Topics In Information And Coding Theory** Isaac Woungang, Sudip Misra, Subhas Chandra Misra, 2010-02-26 The last few years have witnessed rapid advancements in information and coding theory research and applications This book provides a comprehensive guide to selected topics both ongoing and emerging in information and coding theory Consisting of contributions from well known and high profile researchers in their respective specialties topics that are covered include source coding channel capacity linear complexity code construction existence and analysis bounds on codes and designs

space time coding LDPC codes and codes and cryptography All of the chapters are integrated in a manner that renders the book as a supplementary reference volume or textbook for use in both undergraduate and graduate courses on information and coding theory As such it will be a valuable text for students at both undergraduate and graduate levels as well as instructors researchers engineers and practitioners in these fields Supporting Powerpoint Slides are available upon request for all instructors who adopt this book as a course text

**Lie Groups** Harriet Pollatsek, 2024-11-15 This textbook is a complete introduction to Lie groups for undergraduate students The only prerequisites are multi variable calculus and linear algebra The emphasis is placed on the algebraic ideas with just enough analysis to define the tangent space and the differential and to make sense of the exponential map This textbook works on the principle that students learn best when they are actively engaged To this end nearly 200 problems are included in the text ranging from the routine to the challenging level Every chapter has a section called Putting the pieces together in which all definitions and results are collected for reference and further reading is suggested

**Codes: An Introduction to Information Communication and Cryptography** Norman L. Biggs, 2008-12-16 Many people do not realise that mathematics provides the foundation for the devices we use to handle information in the modern world Most of those who do know probably think that the parts of mathematics involved are quite classical such as Fourier analysis and differential equations In fact a great deal of the mathematical background is part of what used to be called pure mathematics indicating that it was created in order to deal with problems that originated within mathematics itself It has taken many years for mathematicians to come to terms with this situation and some of them are still not entirely happy about it This book is an integrated introduction to Coding By this I mean replacing symbolic information such as a sequence of bits or a message written in a natural language by another message using possibly different symbols There are three main reasons for doing this Economy data compression Reliability correction of errors and Security cryptography I have tried to cover each of these three areas in sufficient depth so that the reader can grasp the basic problems and go on to more advanced study The mathematical theory is introduced in a way that enables the basic problems to be stated carefully but without unnecessary abstraction The prerequisites sets and functions matrices finite probability should be familiar to anyone who has taken a standard course in mathematical methods or discrete mathematics A course in elementary abstract algebra and or number theory would be helpful but the book contains the essential facts and readers without this background should be able to understand what is going on

There are a few places where reference is made to computer algebra systems

**Coding Theory and Quantum Computing** David Evans, 2005 A conference Coding Theory and Quantum Computing was held in Charlottesville VA to provide an opportunity for computer scientists mathematicians and physicists to interact about subjects of common interest This proceedings volume grew out of that meeting It is divided into two parts Coding Theory and Quantum Computing In the first part Harold Ward gives an introduction to coding theory Other papers survey recent important work such as coding theory applications of

Grobner bases methods of computing parameters of codes corresponding to algebraic curves and problems in the theory of designs The second part of the book covers a wide variety of directions in quantum information with an emphasis on understanding entanglement The material presented is suitable for graduate students and researchers interested in coding theory and in quantum computing

*A Course in Combinatorics* J. H. van Lint, R. M. Wilson, 2001-11-22 This is the second edition of a popular book on combinatorics a subject dealing with ways of arranging and distributing objects and which involves ideas from geometry algebra and analysis The breadth of the theory is matched by that of its applications which include topics as diverse as codes circuit design and algorithm complexity It has thus become essential for workers in many scientific fields to have some familiarity with the subject The authors have tried to be as comprehensive as possible dealing in a unified manner with for example graph theory extremal problems designs colorings and codes The depth and breadth of the coverage make the book a unique guide to the whole of the subject The book is ideal for courses on combinatorial mathematics at the advanced undergraduate or beginning graduate level Working mathematicians and scientists will also find it a valuable introduction and reference

**Encyclopaedia of Mathematics** Michiel Hazewinkel, 2013-12-01 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977 1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivision has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science engineers and teachers of mathematics These articles treat their material at a fairly general level and aim to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques

Geometry Revealed Marcel Berger, 2010-07-23 Both classical geometry and modern differential geometry have been active subjects of research throughout the 20th century and lie at the heart of many recent advances in mathematics and physics The underlying motivating concept for the present book is that it offers readers the elements of a modern geometric culture by means of a whole series of visually appealing unsolved or recently solved problems that require the creation of concepts and tools of varying abstraction Starting with such natural classical objects as lines planes circles spheres polygons polyhedra curves surfaces convex sets etc crucial ideas and above all abstract concepts

needed for attaining the results are elucidated These are conceptual notions each built above the preceding and permitting an increase in abstraction represented metaphorically by Jacob's ladder with its rungs the ladder in the Old Testament that angels ascended and descended In all this the aim of the book is to demonstrate to readers the unceasingly renewed spirit of geometry and that even so called elementary geometry is very much alive and at the very heart of the work of numerous contemporary mathematicians It is also shown that there are innumerable paths yet to be explored and concepts to be created The book is visually rich and inviting so that readers may open it at random places and find much pleasure throughout according their own intuitions and inclinations Marcel Berger is the author of numerous successful books on geometry this book once again is addressed to all students and teachers of mathematics with an affinity for geometry

*Basic Concepts in Information Theory and Coding* Solomon W. Golomb, Robert E. Peile, Robert A. Scholtz, 2013-03-09 Basic Concepts in Information Theory and Coding is an outgrowth of a one semester introductory course that has been taught at the University of Southern California since the mid 1960s Lecture notes from that course have evolved in response to student reaction new technological and theoretical developments and the insights of faculty members who have taught the course including the three of us In presenting this material we have made it accessible to a broad audience by limiting prerequisites to basic calculus and the elementary concepts of discrete probability theory To keep the material suitable for a one semester course we have limited its scope to discrete information theory and a general discussion of coding theory without detailed treatment of algorithms for encoding and decoding for various specific code classes Readers will find that this book offers an unusually thorough treatment of noiseless self synchronizing codes as well as the advantage of problem sections that have been honed by reactions and interactions of several generations of bright students while Agent 00111 provides a context for the discussion of abstract concepts *Mapmatics* Paulina Rowińska, 2024-09-17 Mathematician Paulina Rowińska leads us across the globe to discover the myriad connections between math and maps and how they've shaped not just our sense of space but our worldview Encyclopaedia of Mathematics M. Hazewinkel, 2013-11-11

*Guide to Information Sources in Mathematics and Statistics* Martha A. Tucker, Nancy D. Anderson, 2004-09-30 This book is a reference for librarians mathematicians and statisticians involved in college and research level mathematics and statistics in the 21st century We are in a time of transition in scholarly communications in mathematics practices which have changed little for a hundred years are giving way to new modes of accessing information Where journals books indexes and catalogs were once the physical representation of a good mathematics library shelves have given way to computers and users are often accessing information from remote places Part I is a historical survey of the past 15 years tracking this huge transition in scholarly communications in mathematics Part II of the book is the bibliography of resources recommended to support the disciplines of mathematics and statistics These are grouped by type of material Publication dates range from the 1800s onwards Hundreds of electronic resources some online both dynamic and static some in fixed media are listed among

the paper resources Amazingly a majority of listed electronic resources are free **A Course in Modern Geometries**

Judith N. Cederberg,2013-03-09 A Course in Modern Geometries is designed for a junior senior level course for mathematics majors including those who plan to teach in secondary school Chapter 1 presents several finite geometries in an axiomatic framework Chapter 2 introduces Euclid s geometry and the basic ideas of non Euclidean geometry The synthetic approach of Chapters 1 2 is followed by the analytic treatment of transformations of the Euclidean plane in Chapter 3 Chapter 4 presents plane projective geometry both synthetically and analytically The extensive use of matrix representations of groups of transformations in Chapters 3 4 reinforces ideas from linear algebra and serves as excellent preparation for a course in abstract algebra Each chapter includes a list of suggested sources for applications and or related topics *Covering Codes*

G. Cohen,I. Honkala,S. Litsyn,A. Lobstein,1997-04-14 The problems of constructing covering codes and of estimating their parameters are the main concern of this book It provides a unified account of the most recent theory of covering codes and shows how a number of mathematical and engineering issues are related to covering problems Scientists involved in discrete mathematics combinatorics computer science information theory geometry algebra or number theory will find the book of particular significance It is designed both as an introductory textbook for the beginner and as a reference book for the expert mathematician and engineer A number of unsolved problems suitable for research projects are also discussed

*Information and Coding Theory* Gareth A. Jones,J.Mary Jones,2012-12-06 As this Preface is being written the twentieth century is coming to an end Historians may perhaps come to refer to it as the century of information just as its predecessor is associated with the process of industrialisation Successive technological developments such as the telephone radio television computers and the Internet have had profound effects on the way we live We can see pictures of the surface of Mars or the early shape of the Universe The contents of a whole shelf load of library books can be compressed onto an almost weight less piece of plastic Billions of people can watch the same football match or can keep in instant touch with friends around the world without leaving home In short massive amounts of information can now be stored transmitted and processed with surprising speed accuracy and economy Of course these developments do not happen without some theoretical basis and as is so often the case much of this is provided by mathematics Many of the first mathematical advances in this area were made in the mid twentieth century by engineers often relying on intuition and experience rather than a deep theoretical knowledge to lead them to their discoveries Soon the mathematicians delighted to see new applications for their subject joined in and developed the engineers practical examples into wide ranging theories complete with definitions theorems and proofs

Permutation Groups John D. Dixon,Brian Mortimer,2012-12-06 Permutation Groups form one of the oldest parts of group theory Through the ubiquity of group actions and the concrete representations which they afford both finite and infinite permutation groups arise in many parts of mathematics and continue to be a lively topic of research in their own right The book begins with the basic ideas standard constructions and important examples in the theory of permutation groups It then

develops the combinatorial and group theoretic structure of primitive groups leading to the proof of the pivotal O'Nan-Scott Theorem which links finite primitive groups with finite simple groups Special topics covered include the Mathieu groups multiply transitive groups and recent work on the subgroups of the infinite symmetric groups This text can serve as an introduction to permutation groups in a course at the graduate or advanced undergraduate level or for self study It includes many exercises and detailed references to the current literature

*Ghosts of Transparency* Michael R. Doyle, Selena Savić, Vera Bühlmann, 2019-09-23 In this book the editors focus on architecture and communication from various different perspectives taking into account that the term architecture is used for buildings as well as in the context of computer software Data and software also impact on our cities raw data however do not convey any information in order to generate information and communication they have to be organized and must make sense to the reader The contributions avoid clear separation of the various communication spheres of their disciplines Instead they use the wide range of approaches to explore meanings an ambitious aim that leaves the destination wide open the reader is invited to share in this adventure



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