

# Lecture Notes in Mathematics

Edited by A. Dold and B. Eckmann

Subseries: USSR

Adviser: L. D. Faddeev, Leningrad

1168

---

S. S. Aгаian

Hadamard Matrices and  
Their Applications

---



Springer-Verlag  
Berlin Heidelberg New York Tokyo

**Author**

S. S. Agaian  
Computer Center of the Academy of Sciences  
Sevak str. 1, Erevan 44, USSR

**Consulting Editor**

D. Yu. Grigorev  
Leningrad Branch of the Steklov Mathematical Institute  
Fontanka 27, 191011 Leningrad, D-11, USSR

Mathematics Subject Classification (1980): 05XX; 05BXX

ISBN 3-540-16056-6 Springer-Verlag Berlin Heidelberg New York Tokyo  
ISBN 0-387-16056-6 Springer-Verlag New York Heidelberg Berlin Tokyo

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically those of translation, reprinting, re-use of illustrations, broadcasting, reproduction by photocopying machine or similar means, and storage in data banks. Under § 54 of the German Copyright Law where copies are made for other than private use, a fee is payable to "Verwertungsgesellschaft Wort", Munich.

© by Springer-Verlag Berlin Heidelberg 1985  
Printed in Germany

Printing and binding: Beltz Offsetdruck, Hemsbach/Bergstr.  
2146/3140-543210

## CONTENTS

Introduction .....	1
§ 1. Basic definitions, notations and auxiliary results ...	5
Chapter 1. CONSTRUCTION OF CLASSIC HADAMARD MATRICES .....	11
§ 2. Methods of construction for Hadamard matrices .....	11
§ 3. Some problems of construction for Hadamard matrices ..	49
§ 4. New method for Hadamard matrices construction .....	78
Chapter 2. CONSTRUCTION OF GENERALIZED HADAMARD MATRICES .....	103
§ 5. Generalized Hadamard matrices .....	103
§ 6. Construction of high-dimensional Hadamard matrices ...	114
Chapter 3. APPLICATION OF HADAMARD MATRICES .....	134
§ 7. Hadamard matrices and problems of information Theory .	134
§ 8. Hadamard matrices and design theory .....	166
§ 9. Other applications of Hadamard matrices .....	171
Appendix 1. UNANSWERED PROBLEMS .....	178
Appendix 2. TABLES OF BLOCK-CIRCULANT, BLOCK-SYMMETRIC (PLANE AND HIGH-DIMENSIONAL) HADAMARD MATRICES OF ORDER $(4n)$ .	180
References .....	192
Subject Index .....	216