

## <<矩阵结合方案>>

### 图书基本信息

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作者：Yanchao Zhao 著

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译者：Jianmin Ma

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## 前言

The concept of the association scheme together with partially balanced incomplete block designs was defined in its own right by R. C. Bose and T. Shimamoto in 1952. It was introduced to describe the balance relations among the treatments of partially balanced in-complete block designs. Association schemes have close connections with coding theory, graph theory, and finite group theory, and in particular, provide a framework for studying codes and designs. By the 1980s, association scheme theory was an important branch of algebraic combinatorics, and the research work on association scheme theory had grown tremendously. The study of association schemes in China was started by Professors L. C. Chang and Pao-Lu Hsu in the late 1950s. Later, my students and I began to construct association schemes and block designs using various subspaces of vector spaces under the action of classical groups. These results were collected in the monograph *Studies in Finite Geometries and the Construction of Partially Incomplete Block Designs* by Z. Wan, Z. Dai, X. Feng, and B. Yang published by Science Press ( Beijing, 1966 ). In the mid-1960s, I constructed a family of association schemes on Hermitian matrices and computed the parameters of the lower dimensional ones [20] and started a new direction of construction of association schemes on matrices. The association scheme theory developed later indicates that the association schemes of maximal totally isotropic subspaces and of Hermitian matrices are known as primitive P- and O-polynomial association schemes.

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### 内容概要

本书论述有限域上各类典型矩阵在群作用下构作的结合方案，其内容主要包括有限域上的长方矩阵、交错矩阵、Hermite矩阵、对称矩阵和二次型构作的结合方案，导出各类结合方案的一般参数计算公式，讨论这些结合方案的本原性、对偶性、P多项式等基本性质以及自同构群。书中还特别论述了特征数为2时二次型结合方案的特征值及其聚合方案的对偶方案。该书可供各大专院校作为教材使用，也可供从事相关工作的人员作为参考用书使用。

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## 章节摘录

插图：The concept of the association scheme together with partially balanced incomplete block designs was defined in its own right by R. C. Bose and T. Shimamoto in 1952. It was introduced to describe the balance relations among the treatments of partially balanced in-complete block designs. Association schemes have close connections with coding theory, graph theory, and finite group theory, and in particular, provide a framework for studying codes and designs. By the 1980s, association scheme theory was an important branch of algebraic combinatorics, and the research work on association scheme theory had grown tremendously. The study of association schemes in China was started by Professors L. C. Chang and Pao-Lu Hsu in the late 1950s. Later, my students and I began to construct association schemes and block designs using various subspaces of vector spaces under the action of classical groups. These results were collected in the monograph *Studies in Finite Geometries and the Construction of Partially Incomplete Block Designs* by Z. Wan, Z. Dai, X. Feng, and B. Yang published by Science Press (Beijing, 1966). In the mid-1960s, I constructed a family of association schemes on Hermitian matrices and computed the parameters of the lower dimensional ones [20] and started a new direction of construction of association schemes on matrices. The association scheme theory developed later indicates that the association schemes of maximal totally isotropic subspaces and of Hermitian matrices are known as primitive P- and Q-polynomial association schemes. In the late 1970s, Professor Yangxian Wang continued the study of association schemes of matrices. He derived formulas for the parameters of association schemes of Hermitian matrices and constructed association schemes using rectangular matrices and alternate matrices. Later, Professors Yuanji Hut, Xueli Zhu and I studied the association schemes of symmetric matrices in odd characteristic. In the 1990s, Professor Yangxian Wang and his students Jianmin Ma and Changli Ma at that time studied the association schemes of symmetric matrices and quadratic forms in even characteristic. Besides the parameters of these association schemes, they discussed the subschemes, quotient schemes, and duality and automorphisms. So the study of association schemes of matrices has reached a more complete stage. In this monograph, Professors Yangxian Wang, Yuanji Hut, and Dr. Changli Ma collect the results on association schemes of matrices in a systematic way. The aim of this monograph is to study the association schemes of matrices, including construction, parameter calculation, primitivity, duality, automorphisms and polynomial properties, etc. I hope this monograph will provide readers with some methods and tools to study association schemes and bring new results.

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