# CHAPTER 46

# STATISTICS

## Doctoral Theses

01. SHARMA (Rashmi)
**Designs for Diallel Crossing System.**
Supervisor: Prof. Poonam Singh
Th 27801

*Abstract*

The emergence of experimental designs has significantly influenced geneticists and breeders, presenting them with the challenge of discerning combining abilities and attaining efficient results within complex datasets across various factors. In addressing this challenge, the diallel crossing system assumes a pivotal role, offering a structured approach tailored to highly inbred lines. The initial step in constructing a diallel crossing system hinges on a profound understanding of the user`s or researcher`s requirements and preferences. This entails delving into existing methods and looking for new methods to construct designs that not only enhance efficiency but also facilitate the straightforward acquisition of diallel crosses. Breeders harness highly inbred lines, exploring all potential crosses, to decipher the intricate web of genetic interactions. The overarching aim of this study revolves around the development and implementation of user-friendly methodologies for constructing diallel crossing systems. This endeavour unfolds through the utilization of Galois Fields, renowned for their error-reduction capabilities, to construct the desired designs for parental lines that are odd prime or power of odd prime numbers. Additionally, Projective Geometry emerges as a pivotal tool, considering data based on points and lines. The study introduces diverse design sets derived from projective geometry over Galois field of order s, applied to construct Complete Diallel Crossing (CDC) systems catering to prime numbers and powers of prime numbers. Recognizing the potential challenges posed by complete diallel crossing systems for users, the study employs Latin Square Designs for the construction of both complete and Partial Diallel Crossing (PDC) systems across the spectrum of positive integers greater than four. This utilizes Balanced Incomplete Block Designs for CDC system and Partially Balanced Incomplete Block Designs for PDC system. Furthermore, the authentication of obtained designs becomes a crucial step, involving their placement within the most suitable framework. Users also ascertain that these designs yield cost savings while concurrently enhancing efficiency and precision in their analyses. This work culminates with designs evaluation, establishing their optimality through empirical validation.

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Association scheme 7. Conclusion and future directions. Appendices. List of research papers out of the thesis. List of conference presentation. References.

02. SANTOSH BABU
**Some Contributions to the Construction of Mappable Nearly Orthogonal Arrays.**
Supervisor: Prof. Poonam Singh
Th 27802

*Abstract*

The mappable nearly orthogonal arrays (MNOAs) are nearly orthogonal arrays (NOAs) that are mappable to fully orthogonal arrays (OAs) with smaller number of levels of factors than the number of levels in the pre-mapping arrays. The Pre-mapping arrays of these arrays satisfy the property that each column of a group is orthogonal to a large proportion of other columns, and it is measured as the degree of orthogonality denoted by $\bar{\pi}$.The MNOAs have wide applications in computer experiments and other fields as space filling designsbecause of their inherent space filling properties.Mukerjee et al. (2014) introduced the concept of MNOAs and constructed some series of these arrays by using resolvable orthogonal arrays.An important property of MNOAs is that an another MNOA can be obtained with the same number of runs but less columns after deleting one or more columns from a MNOA. However, the main intent is to increase the number of groups for attaining a better degree of orthogonality. This thesis proposes some methods to construct mappable nearly orthogonal arrays by using difference matrices, projective geometry, balanced incomplete designs (BIBDs) and Hadamard matrices.The methods are illustrated through examples and the constructed arrays are tabulated with corresponding value of degree of orthogonality. Many new MNOAs can be constructed by using the proposed methods. Additionally, it was found that some of the constructed MNOAs have a better degree of orthogonality than the existing designs.

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