0. Summary

The material included in this thesis divides itself into three main topics, viz. (i) Construction and analysis of rotatable designs, (ii) An alternative approach for the construction of confounded symmetrical designs, and (iii) Construction of confounded asymmetrical factorial designs. In regard to the first topic a new and simple method of construction of second and third order rotatable designs by using factorial and balanced incomplete block designs with and without unequal blocks has been used. Through this method second and third order rotatable designs, both sequential and non-sequential, with any number of factors can be obtained with reasonably small number of design points. Designs split into blocks of equal size have also been presented together with their method of analysis. A large number of designs which are likely to be of interest have been presented as illustrations.

Three papers containing a part of this investigation have been published and have been appended with this thesis as paper Nos. 1, 2 and 3.

Under the second topic, a simple procedure of construction of confounded symmetrical factorial designs has been presented. A special feature of this method is that the independent treatment combinations in the key block of a confounded symmetrical factorial design are first obtained and next the interactions confounded are just written down by seeing the
columns provided by the independent treatment combinations in the key block written as rows. For the construction of such designs through the usual techniques there is a certain amount of trial and error involved in finding out the suitable interactions to be confounded and also for obtaining the treatment combinations in the key block. The present method eliminates this trial and error procedure. The investigation of obtaining the maximum number of factors that can be accommodated in a given block size without confounding any interactions up to a given order becomes straightforward through this method.

In the third and last section a method of construction of confounded asymmetrical factorial design has been presented. This method has been briefly described below.

The number of blocks per replication in the existing resolvable confounded asymmetrical factorial designs is of the form $s^k$ where $s$ is the power of a prime. The present method provides a technique for the construction of this type of confounded asymmetrical factorial designs.

Given any asymmetrical design involving a number of factors, some of the factors will have $s$ levels each, while the others will have a number of levels other than $s$. Let $s_1$ be the number of levels of a factor in the design. Usually the codes used for the levels of the factor are $0, 1, 2... (s_1-1)$. But instead of using these $s_1$ numbers
as codes for the levels of the factors, we may use any $s_1$ combinations of a number of $p$ factors each at $s$ levels as the codes for the levels of this factor. $p$ will be determined from the relation $s^{p-1} < s_1 < s^p$. This procedure establishes a correspondence between the factor, say, $X$ with $s_1$ levels and a set of $p$ factors each at $s$ levels. These latter factors will be denoted by $X_1, X_2, \ldots X_p$ and can be called $x$-pseudo factors. If $s^p$ is greater than $s_1$ all the combinations of the $p$ pseudo factors are not to be used as codes of the levels of the factor $X$. There will thus be as many sets of pseudo factors as there are factors in the asymmetrical design with number of levels not equal to $s$. The codes for levels of factors with $s$ levels will be as usual $0, 1, 2, \ldots s-1$. These factors will be called real factors. Fixing the codes of all the factors in this way, when the treatment combinations of all these factors are obtained, they become the combinations of a symmetrical factorial design. If now we obtain a confounded symmetrical factorial design in full with these factors having the same number of blocks as in one replication of the asymmetrical design and omit all combinations which contain any non-code combination of any set of pseudo factors, this design will give us a replication of the confounded asymmetrical factorial design.
(iv)

Any interaction of the symmetrical design which is confounded will lead to the confounding of an interaction of the asymmetrical design which is obtainable from it by replacing the pseudo factors in it by their corresponding factors in the asymmetrical design. Thus, a number of interactions of the symmetrical design will correspond to the same interaction of the asymmetrical design.

When one replication of the asymmetrical design is obtained through the corresponding confounded symmetrical design, certain interactions of the symmetrical design will be confounded. These interactions correspond to an equal number of interactions of the asymmetrical design. Now there will be several replications of the symmetrical design such that the interactions confounded in each of these replications correspond to the same set of interactions of the asymmetrical design. The asymmetrical design obtainable from all these replications of the symmetrical design will give a balanced asymmetrical design. By introducing concepts like "partition set" of interactions, "confounding set" of interactions, "generalised set" of interactions, etc., which are incorporated in the body of the paper, the choice of replications necessary for obtaining a balanced design has been made very much easier.

A printed paper containing these investigations forms section 3 of this thesis.
In addition to these contributions, the author has got a number of other contributions also. A list of all the papers published by the author is enclosed with this summary. Among them only the more important contributions have been included in the thesis.