Conclusion

A great deal of contribution has been made in all three aspects of crossover designs, for the handling of carryover effects. New crossover designs have been constructed that allow analysis under the presence of first order carryover effects with a high efficiency of separability. A new format of balanced uniform design is suggested, that permit estimation as well as testing of first order carryover effects. Two new practical models have been introduced to facilitate experimenters to make the right choices. Also a crossover design is attributed with interim analysis.

Chapter 2 contributes in the construction of a crossover design which includes a two step method to construct three types of minimal balanced crossover designs. A terrace is defined and then, the group elements are added to it. The newly defined complementary terraces results in a new series of minimal balanced crossover designs. New minimal strongly balanced crossover designs with an even number of treatments are constructed using complementary terraces which contain successive repetitions of a one group element. The efficiency of separability of our designs can be enhanced by extending the periods, sometimes even to 100%. In case of a simple carryover model, if possible, one should prefer a three period crossover design over the two period designs.

Chapter 3 contributes in analysis of a multi-period crossover design. The main hurdles in the application of a multi-period crossover design is the correlation among observations from the same unit, resulting in violation of OLS assumption, estimation of higher-order carryover effects at least for the purpose of confirmation, loss of variance balance and hence optimality in presence of carryover effects, lengthy treatment sequences, and loss of hard achieved properties when missing observations occur. The crossover design chosen for the estimation in Chapter 3 of this thesis, embeds within smaller crossover design with same number of treatments, and this property makes it special and useful in all of the above mentioned practical situations. These designs, not only permit variance balanced estimation of higher-order carryover effect, but also the interim estimation of treatment effects and estimation under missing observations which could occur in three ways.

In Chapter 4, several new two treatment crossover designs are contributed for five types of carryover models. Introduction of two new forms of carryover models resulted in the detailed characterization of existing, as well as, the newly contributed two treatment crossover designs. The 5M algorithm developed for generating crossover designs, is not time efficient, but it cannot miss any optimal and/or efficient designs under the specified premise. It is a general purpose algorithm, and can be used for generating designs in more than twenty subjects, which are not listed in this thesis. Experimenters will now have more flexibility in the choice of two treatment crossover designs in terms of the number of subjects, the number of repeated measurements, and the handling of carryover effects of treatments. When sure about the form of model, experimenter must select an optimal crossover design, otherwise, opt for a design which is efficient under all five models.

In Chapter 5, a uniform three period three treatment crossover design, consisting of a placebo and two active treatments, is presented as a better alternative to two treatment two period crossover design. Use of a placebo as an additional treatment not only increases the efficiency of separability of treatment and carryover effects, but also permits the test of individual carryover effects prior to analysis of the crossover design. This individual test lead the experimenter to choose the correct analysis from all three possible cases as both, single and none of the two active treatments have carryover effect. The studied design is an excellent choice when an experimenter is vague about the idea of carryover effect.

Chapter 6 contributes several new, three treatment crossover designs consisting of a placebo and two active treatments. Such a crossover design is characterized as an optimal and/or efficient for two to four periods having different number of subjects. More such crossover designs can be constructed by 5M active algorithm. Now the experimenter can use crossover design in three more situation, first, when the carryover of both active treatments are not equal; second, to estimate treatment contrasts under self and mixed carryover model when measurement of subjects is possible up to two periods only; and third, when availability of subjects is a multiple of three. Also experimenters now have more choices of optimal and/or efficient crossover designs for precise comparison of two active treatments in three and four periods.

In Chapter 7, a new class of crossover design is introduced, called as active balanced uniform on periods, which facilitate the experimenter to use crossover designs even when the availability of the experimental units is a prime number. Through the 5M active balanced algorithm contributed in this chapter, the experimenter can generate optimal active balanced uniform on periods crossover design in three periods, for any number of subjects. It is advisable, to use these designs instead of the balanced two treatment designs in two experimental situations, first, when the model under consideration is a self and mixed carryover model, and second, when the idea about nature of carryover is vague.