ABSTRACT

Let f be a bounded real-valued function defined on a bounded subset E of R^s, $s \geq 1$. Recently (1978), H. Niederreiter introduced a quasi-Monte Carlo method for approximating the extreme values of f over E. Sequences with small dispersion, a measure of denseness, are required for this method.

In this thesis, we carry out an extensive study of several important small dispersion sequences to determine their relative suitability for the method. For the unit square, we introduce a sequence, the dispersion of which is of the smallest order of magnitude with the best value of the implied constant. For an important class of small dispersion sequences, namely Hammersley sequences in the unit square, we determine an explicit formula for the dispersion. A method for calculating the exact value of the dispersion of any finite sequence in I^s, the s-dimensional unit cube, is introduced.

Our numerical investigations reveal that for some functions, the method as proposed by Niederreiter, will have too small a rate of convergence. We introduce a modification to the method, and it is demonstrated that the new method is considerably more effective.

After satisfactorily treating the problem of generating suitable small dispersion sequences in I^s, we develop a theory for generating these sequences in other domains, and it is shown how to effectively implement the quasi-Monte Carlo methods in these domains.