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Sujet :

Quasi-Monte Carlo and rotation sampling

Simulation of quasi-Monte Carlo type [1] is a deterministic analogous of Monte Carlo techniques, where pseudo-random sequences are replaced by the so-called low discrepancy sequences which are faster equi-distributed over the integration domain, resulting therefore in a better “sampling”.

The goal of this internship is to study whether quasi-Monte Carlo methods could be used in a multidimensional generalization of the so-called rotation sampling which has been proved to provide an important variance reduction in the simulation of Markov chains [2], via a lattice of the interval [0,1]. Indeed, in many practical problems, realizing a transition can require (or is much simpler when) using several random numbers, and not only one. A natural extension of the one-dimensional regular lattice (used in rotation sampling) is then to use a low discrepancy sequence. The gain that can be obtained with respect to a crude Monte Carlo simulation has to be studied, theoretically and numerically.

During the work, the mehod will be compared, both theretically and numerically, with the newly developped method array-RQMC [3] which, in a similar spirit, is devoted to the simulation of Markov chains, but for a totally ordered state space.

[1] H. Niederreiter. *Random Number Generation and Quasi-Monte Carlo Methods*. CBMS-SIAM 63, Philadelphia, 1992.

[2] G.S. Fishman. Accelerated Accuracy in the Simulation of markov Chains. *Operations research*, Vol. 31, Num. 3, pages 466-487, 1983.

[3] P. L'Ecuyer, C. Lécot and B. Tuffin. A Randomized Quasi-Monte Carlo Method for Markov Chains. Submitted.