國立交通大學應用數學系
學術演講公告

主講人：Frances Y. Kuo (School of Mathematics and Statistics, University of New South Wales, Sydney, Australia，理論中心訪問學者)

講　題：High-dimensional integration: the Quasi-Monte Carlo (QMC) way

時　間：105 年 9 月 13 日(星期二) 下午 2:00 –3:00

地　點：(光復校區) 科學一館 223 室

茶　會：當天下午 1:30 (科學一館 205 室)

Abstract

High dimensional computation -- that is, numerical computation in which there are very many or even infinitely many continuous variables -- is a new frontier in scientific computing, with applications ranging from financial mathematics such as option pricing or risk management, to groundwater flow, heat transport, and wave propagation. Often the difficulties come from uncertainty or randomness in the data, e.g., in groundwater flow from permeability that is rapidly varying and uncertain, or in heat transport from uncertainty in the conductivity. These high dimensional problems present major challenges to computational resources, and requires serious mathematical efforts in devising new and effective methods.

This talk will provide a contemporary review of quasi-Monte Carlo (QMC) methods for approximating high dimensional integrals. I will highlight some recent developments on "lattice rules" and "higher order digital nets". One key element is the "fast component-by-component construction" which yields QMC methods with a prescribed rate of convergence for sufficiently smooth functions. Another key element is the careful selection of parameters called "weights" to ensure that the worst case errors in an appropriately weighted function space are bounded independently of the dimension. Then I will showcase how this modern QMC theory can be tuned for a number of applications, including PDEs with random coefficients.

References

[1] J. Dick, F. Y. Kuo, and I. H. Sloan, High-dimensional integration: the quasi-Monte Carlo way, Acta Numerica, 22, 133--288 (2013).

[2] F. Y. Kuo and D. Nuyens, Application of quasi-Monte Carlo methods to elliptic PDEs with random diffusion coefficients -- a survey of analysis and implementation, Foundations of Computational Mathematics, 67 pages, in press (2016).

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