"Periodicity oils the wheels – periodicity for uncertainty quantification"

Ian H. Sloan
University of New South Wales, Sydney Australia

Warsaw 2022

Since the invention of quasi-Monte Carlo (QMC) integration mid-twentieth century, there have always been two versions of QMC: the periodic, associated with Korobov, Bahvalov, Zaremba, Hua and others; and the non-periodic, associated with Halton, Hlawka, Sobol', and more recently Niederreiter, Dick and others. The periodic setting offers the profound benefits of Fourier series, but has lacked serious high-dimensional applications.

After a review of the periodic setting, including especially joint work with Henryk Wozniakowski, I will describe the recent development of a periodic QMC method for high-dimensional approximation in the context of uncertainty quantification. In this work, jointly with Vesa Kaarnioja, Yoshihito Kazashi, Frances Kuo and Fabio Nobile, an elliptic partial differential equation with a random input field is modelled in a non-standard way with periodic random variables, giving a computational cost that grows merely linearly with dimensionality. The method is feasible even with hundreds of random variables.