Whitehead Prize: citation for Aretha Teckentrup

Short citation:

Dr Aretha Teckentrup of the University of Edinburgh is awarded a Whitehead Prize for her incisive research contributions to the foundations of research in uncertainty quantification, at the interface of numerical analysis and probability.

Long citation:

Dr Aretha Teckentrup of the University of Edinburgh is awarded a Whitehead Prize for her incisive research contributions to the foundations of research in uncertainty quantification, at the interface of numerical analysis and probability.

Teckentrup is a lead contributor to a sequence of papers which demonstrated that Mike Giles' multilevel Monte Carlo method (2008) can be extended in important new directions. Giles' work found initial application in the simulation of stochastic ordinary differential equations (SDEs) arising in finance. It rests on analysis of the interplay between Monte Carlo error, the error in approximation of the SDE and an optimal, recursive, balancing of these contributions. Teckentrup demonstrated that the idea of multilevel Monte Carlo can be transferred to partial differential equations (PDEs) with random data, and in particular to divergence form elliptic PDEs with log-normal coefficients, a class of problems prototypical of applications arising in subsurface geophysics. Teckentrup also showed how the ideas of multilevel approximation could be used within the context of Markov Chain Monte Carlo, widely used in the solution of Bayesian inverse problems. This body of work on multilevel Monte Carlo is characterised by focusing on problems of clear applied interest which require the resolution of non-trivial problems in analysis at the interface of approximation theory and probability.

In recent work, Teckentrup has made substantial contributions to the theory of Gaussian processes, within the context of uncertainty quantification. She has studied the use of Gaussian process surrogate models, for the parameter-to-data map within Bayesian inverse problems, demonstrating that a widely used computational approach to inverse problems, dating back to an influential paper of Sacks et. al. in 1989, can be placed on a firm theoretical footing: the error between the desired probability distribution, and that resulting from the use of a Gaussian process surrogate for the parameter-to-data map, is estimated in suitable probability metrics.