5th Singapore Mathematics Symposium

Date: 26 September, 2014 (Friday)
Venue: National University of Singapore (S17 LT34, next to Department of Mathematics)
Time: 1pm – 5:15pm

Schedule:
1:00 – 1:10: Welcome by Ling San, SMS president
1:10 – 2:00: Logical analysis of Ramsey's theorem by Chong Chi Tat, NUS
2:00 – 2:50: From continuous to discrete infinite-dimensional analysis by Nicolas Privault, NTU
2:50 – 3:20: Tea break
3:20 – 4:10: The mathematics and the physics of the moving contact line problem by Ren Weiqing, NUS
4:10 – 5:00: Approximate Bayesian computation and Bayesian model criticism by David John Nott, NUS
5:00 – 5:15: Poster Prize Presentation and Closing Remarks

Titles/abstract/biography of speakers at 5th Singapore Mathematical Symposium

Speaker: Professor Chong Chi Tat (Department of Mathematics, NUS)

Title: Logical analysis of Ramsey's theorem

Abstract: Ramsey's theorem (proved in 1931) concerns the existence of infinite homogeneous sets for finite colouring of n-tuples of natural numbers. This theorem has evolved into a combinatorial principle studied extensively by logicians. This talk will present the historical and mathematical development of the principle, from the logical perspective.

Speaker: Professor Nicolas Privault (School of Physical and Mathematical Sciences, NTU)

Title: From continuous to discrete infinite-dimensional analysis

Abstract: This talk will start with a review of analysis on Gaussian space, motivated by connections with stochastic calculus and PDEs. The Gaussian model will then be transferred to the discrete setting of random point processes by a natural isomorphism. This transfer will allow us to consider a differential structure on discrete spaces and applications to the stochastic geometry of Poisson point processes

---

Speaker: Professor Ren Weiqing (Department of Mathematics, NUS)

Title: The mathematics and the physics of the moving contact line problem

Abstract: The moving contact line problem is a classical problem in fluid mechanics. The difficulty stems from the fact that the classical Navier-Stokes equation with no-slip boundary condition predicts a non-physical singularity at the contact line with infinite rate of energy dissipation. Partly for this reason, mathematical and numerical studies of free boundary problems in fluids have so far avoided dealing with realistic solid boundaries. Many modified continuum models have been proposed to overcome this difficulty. They all succeed in removing the singularity, but they leave behind the question: which one of these models is faithful to the microscopic physics near the contact line region? This and related questions can be answered by using continuum theory, molecular dynamics and the more recently developed multiscale techniques. We will discuss how these techniques can be combined to give us a better understanding of the fundamental physics of the moving contact line and formulate simple and effective models, which not only give a faithful description of the physical process but also remove the singularities. We also illustrate how this model can be used to analyze hysteresis and other important physical problems for the moving contact line.

Speaker: Professor David John Nott (Department of Statistics and Applied Probability, NUS)

Title: Approximate Bayesian computation and Bayesian model criticism

Abstract: This talk will be about Bayesian model criticism, or how to check whether a statistical model fits the data when inference is being done using a Bayesian approach. A brief overview of Bayesian inference and of current concepts and controversies in the area will be given. Following this, some computational problems which arise in Bayesian model checking will be discussed. In the Bayesian framework a standard approach to model criticism is to compare some function of the observed data to a reference predictive distribution. The result of the comparison can be summarized in the form of a p-value, and it's well known that computation of some kinds of Bayesian predictive p-values can be challenging. The use of regression adjustment approximate Bayesian computation (ABC) methods will be explored for this task. Two problems are considered. The first is the calibration of posterior predictive p-values so that they are uniformly distributed under some reference distribution for the data. Computation is difficult because the calibration process requires repeated approximation of the posterior for different data sets under the reference distribution. The second problem considered is approximation of distributions of prior predictive p-values for the purpose of choosing weak informative priors in the case where the model checking statistic is expensive to compute. Here the computation is difficult because of the need to repeatedly sample from a prior predictive distribution for different values of a prior hyperparameter. The method will be illustrated with some simple examples.
