慶應義塾大学　21世紀COEプログラム 「統合数理科学：現象解明を通した数学の発展」

Pathways Lecture Series in Mathematics, Keio

Speaker : Prof. Peter W. Jones
(Yale University)

Place : 14-216, Yagami Campus
Faculty of Science andTechnology, Keio University

Topics in Analysis, Geometry, and Probability

Lecture 1

16:30-18:00   September 26, Monday, 2005

Random Curves in Analysis and Physics

We discuss random filaments, sheets, and curves in various mathematical and physical problems. One of the greatest breakthroughs in recent years has been Oded Schramm's introduction of SLE (Stochastic Loewner Evolution) which provides classes of random connected sets (traces) in the plane. With varying choices of parameter (called kappa) one obtains different classes of traces, and many of these have classical physical meaning. We also discuss a new method to use the Gaussian Free Field to generate random homeomorphisms of the circle as well as related loops on the Sphere.

Lecture 2

16:30-18:00 September 27, Tuesday, 2005

Diffusion Geometry

We discuss work by Yale's group working in the new field of Diffusion Geometry. The idea is to mimic the ideas of Laplacian graph theory and produce a version of Brownian Motion (diffusion) as well as a "Laplace operator" on point sets in Euclidean space. One then uses the associated eigenfunctions as new local coordinates on the given set. This is useful in the study/organization of data sets (e.g. documents) or data arising in dynamical systems of physics or chemistry. This point of view turns out to have surprising relations to Riemann's uniformization theorem for Riemann surfaces. (The last topic is joint work with Mauro Maggioni and Raanan Schul.)

Lecture 3

16:30-18:00 September 28, Wednesday, 2005

Mutiscale SVD and Geometry of Measures

We discuss joint work with Gilad Lerman on the geometry of measures in Euclidean space. A multiscale version of the singular value decomposition (SVD) is defined. This provides a tool for showing when a probability measure puts large measure on a D-dimensional "good manifold-like structure" of small area. Applications are shown including the problem of edge detection in image processing.