Center for Mathematical Sciences Lectures

Mallat Family Fund for Research in Mathematics

invites you to a

SPECIAL LECTURE SERIES

to be presented by

Professor Robert Bryant

Mathematical Sciences Research Institute, Berkeley

All lectures will take place at
Auditorium 232, Amado Mathematics Building

Lecture I:
Monday, 13 December, 2010 at 15:30

A Visit to the Finsler World

Many people aren't aware that, when Bernard Riemann revolutionized the study of differential geometry in his famous 1854 lecture, he had in mind a more general concept of geometry than what we now call Riemannian geometry. His original vision included a kind of geometry that could be used to study a wide range of problems in the calculus of variations and optimization, but the development of this more general geometry, nowadays called Finsler geometry, had to wait many more years before being explored in depth. It is now in a vigorous phase of development, and, in this lecture, I want to (re-)introduce Riemann's original idea and sketch some of the new developments. I'll emphasize how the Finsler world compares and contrasts with the more familiar Riemannian world and illustrate some of its applications and surprising connections with other areas of mathematics.

Lecture II:
Wednesday, 15 December, 2010 at 15:30

Cartan's Generalization of Lie's Third Fundamental Theorem

In his fundamental works in the first decade of the 20th century on what are now called Lie pseudo-groups, Elie Cartan proved several generalizations of Lie's Third Theorem on the (local) existence of Lie groups. These results anticipate by many years the theory of Lie groupoids and Lie algebroids that is still being developed today.

In this talk, I will review Cartan's (and others') results in this direction and illustrate their importance by showing how they can be applied to solve several recent problems in differential geometry, particularly problems involving the existence of metrics with special holonomy and prescribed curvature problems.

Lecture III:
Thursday, 16 December, 2010 at 15:30

The Affine Bonnet Problem

The classical Euclidean problem studied by Bonnet was to determine whether, and in how many ways, a Riemannian surface can be isometrically embedded into Euclidean 3-space so that its mean curvature is a prescribed function. He found that, generically, specifying the metric and mean curvature allowed no solution but that there are special cases in which, not only are there solutions, but there are even 1-parameter families of distinct solutions. Much later, these `Bonnet surfaces' were found to be intimately connected with integrable systems and Lax pairs.
In this talk, I will consider the analogous problem in affine geometry: To determine whether, and in how many ways, a surface endowed with a Riemannian metric g and a function H can be immersed into affine 3-space in such a way that the induced Blaschke metric is g and the induced affine mean curvature is H. This affine problem is, in many ways, richer and more interesting than the corresponding Euclidean problem. I will classify the pairs (g, H) that display the greatest flexibility in their solution space and tell what is known about the (suspected) links with integrable systems and Lax pairs.