

30th Annual Conference of the Ramanujan Mathematical Society
Abstracts of Plenary Talks

May 15, 10:00 - 10 50 AM

Prsidential Address

Set Theory and Curvature

Ravi S. Kulkarni, Bhaskaracharya Institute of Mathematics, Pune

Abstract: Sets have been used and mentioned from ancient times, and not only in Mathematics. But these references were mainly to finite collections, and their counting in various combinatorial contexts. But the "set theory" as a serious theory for infinite sets arose in the latter half of the 19th century in the works of Dedekind, Cantor, Hausdorff, Peano, Frege, Russel-Whitehead. Now we take set theory as a foundation of mathematics, which Hilbert described as "a paradise created by Cantor". In the first part of the talk I shall try to explain the three benefits mathematics has derived from set theory.

- (1) Set theory provided an ontology for mathematics.
- (2) It provided an expression for mathematical thoughts of "space", "number" and "symmetry".
- (3) It clarified the notion of infinity.

In the latter part I shall try to explain how this has helped formulating the sophisticated notion of curvature, which is central to differential geometry. We shall briefly review how the notion of curvature has evolved from Newton, Huygens, Euler, Gauss, Riemann, E. Cartan and how it was used by Einstein for explaining gravity.

May 15, 4:00 - 4:50 PM

Measurement, Mathematics and Information Technology

M. Ram Murty, Queen's University, Ontario

Abstract: In this talk, we will highlight the importance of measurement, discuss what can and cannot be measured. Focusing on the measurement of position, importance, and shape, we illustrate by discussing the mathematics behind, GPS, Google and laser surgery. The talk will be accessible to a wide audience.

May 16, 9:00 - 9:50 AM

Hyperplane sections of determinantal varieties over finite fields

Sudhir R. Ghorpade, IIT Bombay, Mumbai

Abstract: Consider the classical determinantal variety defined by the vanishing of all minors of a fixed size of a $m \times n$ matrix whose entries are independent indeterminates over a field F . Alternatively, this is the loci of all $m \times n$ matrices with entries in F and rank not exceeding a fixed integer. This algebraic variety has many nice properties and is of considerable interest in algebraic geometry, combinatorics, invariant theory and representation theory. We view it as a projective variety in $(mn - 1)$ -dimensional projective space over F and consider its sections by hyperplanes in the ambient projective space. When F is a finite field with q elements, the question of counting the number of rational points of these hyperplane sections turns out to be of interest in coding theory, and has also a bearing on the geometric properties of the hyperplane sections. In this talk, based mainly on joint work with Peter Beelen, we will attempt to outline a complete answer.

May 16, 10:00 - 10:50 AM

An algebraic theory of algebraic curves

Harold Edwards, New York University, NY

Abstract: In 1882, two papers that dealt with the theory of algebraic curves were published in Crelle's Journal, one a joint paper by Richard Dedekind and Heinrich Weber, and the other by Leopold Kronecker. The Dedekind-Weber paper is regarded as a founding document of modern algebraic geometry, while the Kronecker paper is largely forgotten. The most memorable characteristic of the Kronecker paper is that it is based on purely algebraic notions and constructions, in sharp contrast to the Dedekind-Weber use of complex numbers, which require a decidedly transcendental construction. The talk will sketch a new approach to the theory of algebraic curves that, like Kronecker's, is based entirely on elementary algebra but retains the geometric imagery of Dedekind-Weber's. The key idea is to use Newton's polygon instead of complex numbers to describe points on a curve.

May 16, 4:00 - 4:50 PM

Twisted conjugacy in certain PL-homeomorphism groups

Parameswaran Sankaran, IMSc., Chennai

Abstract: Let $\phi : \Gamma \rightarrow \Gamma$ be an automorphism of an infinite group. One has an action of Γ on itself defined as $\gamma.x = \gamma x \phi(\gamma^{-1})$. The orbits of this action are called ϕ -twisted conjugacy classes. The number of ϕ -twisted conjugacy classes is called the Reidemeister number of ϕ , denoted $R(\phi)$. If $R(\phi) = \infty$ for every $\phi \in \text{Aut}(\Gamma)$, one says that Γ has the $R(\infty)$ -property. It is an interesting problem to determine which infinite groups have the $R(\infty)$ -property. After a survey of some known results, we will consider certain classes of PL-homeomorphisms of a compact interval which include the Richard Thompson group and their generalizations. The talk is based on joint work (in progress) with D. L. Gonçalves and R. Strebel.

May 17, 9:00 - 9:50 AM

Two early Ramsey-type theorems in Combinatorial Number Theory: Some early generalizations and some recent results

Sukumar Das Adhikari, HRI, Allahabad

Abstract: Early Ramsey-type theorems include the theorem of Ramsey, and the other results include the celebrated theorem of van der Waerden and a result of Schur. Origins of some of the famous recent developments in mathematics can be traced back to these results. Here we dwell on the Schur and van der Waerden theme - giving some interrelations, having glimpses of different methods employed to deal with these problems, looking at some recent results and open questions.

May 17, 10:00 - 10:50 AM

Invariants for a class of Cowen-Douglas operators

Gadadhar Misra, IISc., Bangalore

Abstract: The explicit description of irreducible homogeneous operators in the Cowen-Douglas class and the localization of Hilbert modules naturally lead to the definition of a smaller class possessing a flag structure. These operators are shown to be irreducible. It is also shown that the flag structure is rigid, that is, the unitary equivalence class of the operator and the flag structure determine each other. A complete set of unitary invariants, which are somewhat more tractable than those of an arbitrary operator in the Cowen-Douglas class, are obtained. (This is a joint work with K. Ji, C. Jiang and D. Keshari)