DEPARTMENT OF MATHEMATICAL SCIENCES

Week of March 18 - 23, 2019

Denksport
Herman Servatius
WPI

The geometry of kinematic frameworks

ABSTRACT: Every bar and joint framework has a configuration space which is an algebraic set which can be studied with tools coming from algebra, combinatorics, geometry and topology. We will show some methods of analysis, and exhibit some frameworks with curious behavior.

Monday, March 18, 2019
10:00AM
Stratton Hall 304

PhD Dissertation Defense
Brian Kodalen

Cometric Association Schemes

ABSTRACT: The combinatorial objects known as association schemes arise in group theory, extremal graph theory, coding theory, the design of experiments, and even quantum information theory. One may think of a d-class association scheme as a d+1 dimensional matrix algebra closed under the entrywise product containing I and J. In this context, an imprimitive scheme is one which admits a subalgebra (subscheme) of block matrices, also closed under the entrywise product. Such systems of imprimitivity provide us with quotient schemes, smaller association schemes which are often easier to understand, providing useful information about the structure of the larger scheme. One important property of any association scheme is that we may find a basis of d+1 idempotent matrices for our algebra. A cometric association scheme is one whose idempotent basis may be ordered E₀, E₁, ..., E_d so that there exist polynomials q₀, q₁, ..., q_d with q_i ◦ (E_i) = E_i and deg(q_i) = i for each i. Imprimitive cometric schemes relate closely to spherical t-distance sets, sets of unit vectors with only t distinct inner products, such as equiangular lines and mutually unbiased bases. A similar type of association schemes known as metric schemes have been studied extensively with fundamental results such as a classification of imprimitive metric schemes dating back to the early 1970's. Analogous results for the cometric case weren't settled until nearly four decades later, with many other questions still open today.

Tuesday, March 19, 2019
12:00PM
Taylor Conference Room

Analysis and PDE Seminar Series
Panu Lahti
University of Augsburg

BV functions and Federer's characterization of sets of finite perimeter in metric spaces

ABSTRACT: We consider the theory of functions of bounded variation (BV functions) in the general setting of a complete metric space equipped with a doubling measure and supporting a Poincaré inequality. Such a theory was first developed by Ambrosio (2002) and Miranda (2003). In particular, I will discuss a metric space proof of Federer's characterization of sets of finite perimeter, i.e. sets whose characteristic functions are BV functions. This characterization states that a set is of finite perimeter if and only if the n-1-dimensional (in metric spaces, codimension one) Hausdorff measure of the set's measure-theoretic boundary is finite.

Thursday, March 21, 2019
12:00PM - 1:00PM
Salisbury Labs 104

Virtual Combinatorics Colloquium
Hosted by the Northeast Combinatorics Network

Jon Kleinberg
Cornell University

Graph-Theoretic Models of Behavioral Phenomena

ABSTRACT: A growing line of research aims to build mathematical models for aspects of collective human behavior, and an important strand of this work is concerned with behavioral biases -- regularities in people's behavior leading to outcomes that are inconsistent with standard models of rational optimization. We show how graph-theoretic models can be a powerful abstraction for these types of settings, focusing on cases where graph structures are used to model processes in which people form plans over time, and face challenges arising from present bias and sunk-cost bias. (This talk is based on joint work with Sigal Oren and Manish Raghavan.)

Thursday, March 21, 2019
2:00PM - 3:00PM
Stratton Hall 203
Colloquium
Rosemary Bailey
University of St. Andrews

Finding Good Designs for Experiments

ABSTRACT: Suppose that there are N experimental units available for an experiment to compare v treatments. The experimental units may be all alike, or they may be partitioned into blocks, or there may be rows and columns. The design is the function allocating treatments to units. It is said to be optimal if it minimizes the average value of the variance of the estimator of the difference between two treatments.

How should we find an optimal design for any given situation, with specified values of N and v? There are some theorems that cover a few cases. These lead on to some general folklore that is not always correct. One combinatorial approach is to make use of pretty patterns, to find designs with high symmetry or regularity. Another is to make a computer search. Sometimes a good design is found by a lucky accident.

Friday, March 22, 2019
11:00AM - 12:00PM
Stratton Hall 203

Stochastic & Financial Math
Common Talk

Guangqu Zheng
University of Kansas

The Probability of Intransitivity in Dice and Close Elections

ABSTRACT: TBD

Friday, March 22, 2019
4:00PM - 5:00PM
Stratton Hall 308

WPI & AWM

Sonia Kovalevsky Day 2019

The WPI Chapter of the Association of Women in Mathematics (AWM) is planning to host a Sonia Kovalevsky Day (SK Day) outreach event for local 6th, 7th, and 8th grade girls on WPI’s campus on Saturday, March 23, 2019. The day's events will include fun and engaging math activities run by current WPI students and faculty, lunch, and a keynote speech by a female mathematician. The aim of SK Day is to bolster the girls’ continued passion and enthusiasm for mathematics while meeting other girls who share similar interests and, of course, having fun!

Named in honor of Sonia Kovalevsky, the first female to obtain a Ph.D. in mathematics, SK Days are nationally-held, locally-organized outreach events with the aim of supporting and encouraging young women to continue their study of mathematics.

Saturday, March 23, 2019
9:00AM-3:00PM
Salisbury Labs