Harmony of Real and Complex Algebraic Geometry

Date   **6~9 December**, 2016

Tues. 6 Dec.		Wed. 7 Dec	
16:10 ~ 17:10	Greg Blekherman(1)	16:10 ~ 17:10	Mateusz Michalek(1)
17:10 ~ 18:10	Rainer Sinn(1)	17:10 ~ 18:10	Greg Blekherman(2)
Thur. 8 Dec.		Fri. 9 Dec.	
17:30 ~ 18:30	Mateusz Michalek(2)	14:00 ~ 15:00	Rainer Sinn(2)

Place   **Rm. 1409**, Natural Sciences B/D E6-1

Abstract

Speaker: **Greg Blekherman** (Georgia Institute of Technology)
Title: **Nonnegative Polynomials and Sums of Squares I and II**
Abstract: A polynomial is called nonnegative if it takes only nonnegative values. Sums of squares of polynomials (and rational functions) are obviously nonnegative. We will review the rich history of this area of real algebraic geometry starting with the work of Hilbert, and explain connections to optimization and the moment problem in real analysis. In the second talk, we
will present several recent results which reveal an unexpected connection with classical algebraic geometry.

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Speaker: **Mateusz Michalek** (Polish Academy of Sciences)

Title: **Toric geometry applied to secant and tangential varieties I and II**

Abstract: The talk is based on a joint work with Oeding-Zwiernik and Perepechko-Suess. We will start by recalling basic facts from toric geometry: a powerful domain relating combinatorial (lattice polytopes and affine monoids) and geometric (closures of images of monomial maps) objects. We will show how this can be used to study secant and tangential varieties of Segre-Veronese varieties. In particular, we present new results on sigularities of these projective varieties.

Speaker: **Rainer Sinn** (Georgia Institute of Technology)

Title: **Matrix Completion and Free Resolutions I and II**

Abstract: A matrix completion problem starts with a partially specified matrix, where some entries are known and some are not. We will be interested in completing a partially specified symmetric matrix to a full positive semidefinite matrix. After motivating examples and reviewing the history of the problem we will explain connections to nonnegative polynomials and sums of squares, and a connection to free resolutions. In the second talk we will explain that the classical matrix completion problem corresponds to the case of a coordinate subspace arrangement (square-free monomial ideal). We will then explain that surprisingly matrix completion problem on a variety is related to some properties of its free resolution.

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