

Doctoral Day Mathematics — December 12, 2014

Time and Place: 10:30–13:00, Seminarraum 2 des Inst. f. Geometrie, Kopernikusgasse 24/IV, TU Graz.

10:30 — Johannes Cuno (TU, advisor W. Woess):

Random Walks on Baumslag-Solitar Groups

Abstract: Baumslag-Solitar groups are given by $BS(m, n) \cong \langle a, b : ab^m = b^n a \rangle$. After a short introduction we fix the group $BS(2, 3)$ and investigate random walks on it. The Poisson-Fürstenberg boundary is a measure space associated to such a random walk which, roughly speaking, models the long time behaviour of the random walk. Our goal is to describe this boundary geometrically. In the past, we have always assumed that our random walk is driven by a measure whose support consists of the standard generators a and b and their inverses. Now, we show how to proceed from nearest neighbour to finite range random walks. In particular, it turns out that, in some sense, our result for nearest neighbour random walks does not depend on the choice of a finite generating set of the group $BS(2, 3)$.

11:00 — Bumrungsak Phuenaree (KFU, advisor F. Kappel):

Traditional Sensitivity Functions in Nonlinear Maximum Likelihood Problems

Abstract: We present a maximum likelihood estimation for estimating the unknown parameters in nonlinear models when the assumption of normality on the error term is violated. In addition we review sensitivity analysis to distinguish between highly influential parameters and less influential parameters in such models. We also use the concept of traditional sensitivity functions to develop a strategy to determine the optimal final time T for an experiment, and to specify the time range of the highest information content with respect to the parameters. Moreover, we consider the role of the traditional sensitivity functions in finding the best sampling distributions. We illustrate these ideas with the Verhulst-Pearl logistic growth model.

11:30 Presentation of the Doctoral School Best Paper Awards

Dijana Kreso (TU, advisor: R. Tichy) for the paper D. Kreso, M. Zieve: On factorizations of maps between curves, *arxiv:1405.4753*.

Johannes Cuno (TU, advisor W. Woess), for the paper J. Cuno, J. Lehnert: The Tits alternative for non-spherical triangles of groups, *arxiv:1405.3433*

11:35 — Break (coffee and refreshments)

12:05 — Roswitha Rissner (TU, advisor S. Frisch):

Null ideal of a matrix.

Abstract: Given a square matrix A with entries in a commutative ring R , the ideal of $R[X]$ consisting of polynomials f with $f(A) = 0$ is called the null ideal of A in $R[X]$. If R is a domain, then the null ideal of every square matrix over R is principal if and only if R is integrally closed. Very little is known about null ideals of matrices over general commutative rings. Better understanding of the null ideals of matrices over $R = \mathbb{Z}/p^n\mathbb{Z}$ (and finite rings in general) would have applications in the theory of integer-valued polynomials and in the theory of polynomial mappings on non-commutative rings. We will present preliminary results and open questions in this area.

12:35 — Martin Kanitsar (KFU, advisor M. Hintermüller):

Shape optimization in fluid dynamics

Abstract: Industrial applications in fluid dynamics, finding an optimal shape with respect to some cost functional is important. The shape gradient calculus is used to derive the sensitivity of the cost functional with respect to changes in the shape. This yields a descent direction within a line search procedure for reducing the objective. The underlying physics are described by the stationary Navier-Stokes equation, the primal equation, and an adjoint equation is used for calculating the shape derivative. An introduction to the calculation of the shape gradient and some aspects on existence of a solution are given, as well as a report on numerical tests is presented.