Oberseminar zur Numerik im SoSe 2016

Im Rahmen des Oberseminars der AG Numerik wird

Herr Philipp Petersen, FG Angewandte Funktionalanalysis, TU Berlin,
am Mittwoch, den 15. Juni 2016, zum Thema

*Discretization of PDEs Using Shearlet Systems*

vortragen.

**Abstract.** During the last decades a trend for the solution of PDEs emerged, that focuses on employing systems from applied harmonic analysis for the discretization and adaptive solution of these equations. Most notably wavelet systems have been used, which in some cases lead to provably optimal solvers for elliptic PDEs. However, in many relevant situations shearlet systems provide an improvement over wavelets in terms of $N$–term approximation rates for functions that have singularities along smooth curves. Moreover, they also yield drastically improved approximation rates when compared with wavelets when approximating functions that have first- or higher-order cartoon-like partial derivatives. We aim to leverage on these improved approximation rates to construct better discretization methods.

The main bottleneck in developing shearlet-based PDE solvers is the fact that originally these systems are constructed as representation systems, or frames, for functions defined on $\mathbb{R}^d$, while most PDEs are defined on a finite domain $\Omega \subset \mathbb{R}^d$. Thus the development of effective PDE solvers crucially depends on the construction of shearlet systems on finite domains, satisfying various boundary conditions.

In this talk we will present a novel construction, coined boundary shearlet system, that satisfies a number of highly desirable features. We will demonstrate that for fixed $s \in \mathbb{N}$ this system constitutes a Gelfand frame for $(H_0^s(\Omega), L^2(\Omega), H^{-s}(\Omega))$ and—after proper reweighting—a frame for $H^s(\Omega)$. Furthermore, we derive approximation rates with respect to the $L^2(\Omega)$ and $H^s(\Omega)$ norms which are superior to approximation rates achieved by wavelets. We will also demonstrate how these findings lead to improved discretization methods and adaptive algorithms for the solution of elliptic PDEs.

This talk is based on joint work with P. Grohs, G. Kutyniok, J. Ma and M. Raslan.

Der Vortrag findet um **16:15 Uhr** im Seminarraum 06D10 am Fachbereich Mathematik und Informatik, Hans-Meerwein Str., Lahnberge, statt.

Es lädt ein die AG Numerik.