

Universität zu Köln

Department Mathematik/Informatik
Prof. Dr. Angela Kunoth



Einladung zum Oberseminar Numerische Analysis

Am Freitag, 06.03.2026 um 11:00 Uhr, im Seminarraum 2 (Raum 204)
der Abteilung Mathematik, Weyertal 86–90, 50931 Köln, spricht

Sara Avesani
(Università della Svizzera Italiana)

zum Thema

FAST MULTISCALE METHODS FOR SCATTERED DATA: THEORY AND APPLICATION OF SAMPLETS

Abstract

Samplets offer a wavelet-like framework specifically designed for scattered and non-uniformly sampled multivariate data. At their core, samplets are localized discrete signed measures with vanishing moments that enable sparse representations of generalized Vandermonde matrices emerging from radial basis function methods. The multiresolution structure supports $\mathcal{O}(N)$ samplet coefficient transforms and $\mathcal{O}(N \log N)$ assembly of compressed system matrices for quasi-uniform datasets of size N . A key application of samplets lies in constructing multiscale interpolation schemes for globally supported radial basis functions, such as Matèrn kernels. These schemes employ successive residual corrections that combine kernels across multiple lengthscales to resolve features at different resolutions. By representing each level in samplet coordinates, the resulting linear systems become sparse with diagonal blocks whose condition numbers remain bounded independently of resolution level. The structure enables stable iterative solvers that converge in a fixed number of iterations, regardless of dataset size. Beyond interpolation, samplets provide powerful tools for analysing the regularity of irregular signals. Through the fast samplet transform, one can quantify local smoothness within Jaffard's microlocal framework: the decay rate of samplet coefficients directly encodes pointwise Hölder regularity. This yields a near-linear time algorithm for detecting edges and characterizing smoothness in scattered data.

Interessenten sind herzlich eingeladen.

Angela Kunoth