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Applied Harmonic Analysis meets Sparse Regularization of Operator Equations

Abstract

Sparse regularization of operator equations has already shown its effectiveness both theoretically and practically. The area of applied harmonic analysis offers a variety of systems such as wavelet systems which provide sparse approximations within certain model situations which then allows to apply this general approach provided that the solution belongs to this model class. However, many important problem classes in the multivariate situation are governed by anisotropic structures such as singularities concentrated on lower dimensional embedded manifolds, for instance, edges in images or shear layers in solutions of transport dominated equations. Since it was shown that the (isotropic) wavelet systems are not capable of sparsely approximating such anisotropic features, the need arose to introduce appropriate anisotropic representation systems. Among various suggestions, shearlets are the most widely used today. Main reasons for this are their optimal sparse approximation properties within a suitable model situation in combination with their unified treatment of the continuum and digital realm, leading to faithful implementations.

In this talk, we will first provide an introduction to sparse regularization of operator equations, followed by an introduction to the area of applied harmonic analysis, in particular, discussing the anisotropic representation system of shearlets and presenting the main theoretical results. We will then analyze the effectiveness of using shearlets for sparse regularization of exemplary operator equations both theoretically and numerically.

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Talk location: Brown Hall 100