MS Thesis Defense

Student: Abhinivesh Devathi

Advisor: Daniela Calvetti

Title: *Uncertainty Quantification for Underdetermined Inverse Problems via Krylov Subspace Iterative Solvers*

Abstract

In the Bayesian framework, inverse problems can be recast as statistical inference problems, in which the noisy observations are used to update the prior beliefs about the unknowns, encoded in the prior distribution. The Bayesian solution to an inverse problem is thus the posterior distribution. While in the traditional deterministic setting a solution to an inverse problem was given by a single regularized estimate, in the statistical setting uncertainty quantification, by exploring the posterior via sampling strategies, is a central task. The topic of this thesis is to investigate the approximation of the posterior distribution by a sample obtained by using Krylov subspace iterative solvers. It is well known that the Bayesian maximum a posteriori estimate is related to the classical Tikhonov regularized solution, and is effectively approximated with iterative solvers equipped with an early stopping criterion. The novelty of this work is to use the latter ones for posterior sampling: a particularly promising direction is to use priorconditioners, or statistically inspired preconditioners, to embed the prior information in the iterative solvers. In that context we have tested different sampling approaches, equipped with a novel early stopping criterion and demonstrate the viability of the approach by computed examples.