Contribution ID: **30** Type: **Plenary talk**

Efficient Krylov-like solvers for model and data driven problems

Tuesday, 27 January 2026 14:00 (1 hour)

This talk is about efficient solution methods for inverse problems, i.e., the task of recovering an object of interest from known but corrupted data available through a known but possibly corrupted model, formulated in a discrete and linear setting. Since these problems are ill posed, variational regularization methods are often applied to recover a meaningful solution. However, variational regularization methods always require a number hyperparameters, i.e., parameters that must be pre-specified in advance, such as regularization parameters. A data-driven approach to determine appropriate hyperparameter values is via a nested optimization framework known as bilevel learning. This talk will focus on novel strategies, based on Krylov methods, to effectively and efficiently solve such bilevel learning problems. Namely: (1) The use of non-standard Krylov methods to solve the regularized problem will be presented, to set a variety of hyperparameters (in addition to the regularization parameters). (2) The application of recycling Krylov subspace methods will be explored, resulting in cheaper computations of each hypergradient in a gradient-based optimization method for solving the bilevel learning problem. The proposed approaches are validated through extensive numerical testing in the context of inverse problems in imaging.

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Session Classification: Session 4