Image reconstruction for dynamic magnetic particle imaging

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Solving an inverse problem means to compute a quantity of interest, which is not directly measurable, given measurements related to the searched-for quantity via a physical model. Inverse problems appear in many technical and physical applications and are commonly solved in a static setup. However, recently the focus turned on dynamic inverse problems where a spatial-temporal quantity from temporal data has to be determined. A huge class of dynamic inverse problems are tomographic imaging applications such as dynamic computer tomography, magnet resonance tomography or new tomographic applications such as magnetic particle imaging (MPI).

MPI is capable of capturing fast dynamic processes in 3D volumes, based on the non-linear response of the magnetic nanoparticles to an applied magnetic field. The image reconstruction is computationally demanding due to a non-sparse system matrix. Therefore, efficient numerical methods for solving the Tikhonov-type regularized minimization problems are needed. In this talk, we present some edge-preserving and spatio-temporal regularization methods and how to efficiently solve the resulting minimization problems. Results are presented for simulated and experimental dynamic MPI data.