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Best Basis Methods for the Modelling and Inversion of Potential Fields

Volker Michel and Roger Telschow

University of Siegen, Geomathematics Group, Department of Mathematics, Siegen, Germany
(michel@mathematik.uni-siegen.de)

There are many trial functions (e.g. on the sphere) available which can be used for the modelling of a potential field. Among them are orthogonal polynomials such as spherical harmonics and radial basis functions such as spline or wavelet basis functions. We present an algorithm, the Regularized Functional Matching Pursuit (RFMP), and an enhancement (the ROFMP), which construct a kind of a best basis out of trial functions of different kinds. This basis is tailored for the particular problem and the given data set. The objective of the optimization is the minimization of the Tikhonov-regularized data misfit. One main advantage is that the constructed approximation inherits the advantages of the different basis systems. By including spherical harmonics, coarse global structures can be represented in a sparse way. However, the additional use of spline basis functions allows a stable handling of scattered data grids. Furthermore, the inclusion of wavelets and scaling functions yields a multiscale analysis of the potential.
In addition, ill-posed inverse problems (like a downward continuation or the inverse gravimetric problem) can be regularized with the algorithm.
We show some numerical examples to demonstrate the possibilities which the algorithms provide.