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On the "Optimal" Choice of Trial Functions for Modelling Potential Fields

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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. Their pros and cons have been widely discussed in the last decades. We present an algorithm, the Regularized Functional Matching Pursuit (RFMP), which is able to choose trial functions of different kinds in order to combine them to a stable approximation of a potential field. One main advantage of the RFMP 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 RFMP provides.