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Regularization Techniques for Nonlinear Inverse Problems

Many inverse problems in practical problem in sciences, technology and medicine can be reduced to solving the equation given by

$$(F \circ \Psi)(x) = y,$$

where $\Psi : C \subseteq X \to Y$ and $F : Y \to Z$ are nonlinear weakly sequentially operators between the Hilbert Spaces X, Y, Z and C is a bounded subset of X. These operators contain the internal structure of the system and the right hand side is a given data, and x is a desired solution. This problem is ill-posed and difficult to solve. In order to address the ill-podness of this problem we applied a new generalization of Tikhonov Regularization. Results on existence, stability and convergence rates are presented. Some numerical examples illustrating the behavior of the algorithm in practical situations.

Reference: G. Chavent and K. Kunish, *Regularization in State Space*, Mathematical Modelling and Numerical Analysis, Vol. 27, N0.5, 1993, pp. 535-564.