Iteratively Regularized Gauss-Newton Method (IRGNM) in Banach space

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Resumo: This talk deals with a combined analysis of regularization and discretization of inverse problems in Banach spaces, specifically in the context of partial differential equations (PDEs). The relevant quantities - parameters and states - have to be discretized, e.g., by the finite element method, and the error due to this discretization has to be appropriately estimated and controlled by error estimators and mesh refinement. Thus one of the main challenges here is to take into account the interplay between mesh size, regularization parameter and data noise level. The focus on the PDEs setting is relevant to the adaptive discretization of the regularized problems. Hence, I will present convergence of the Iteratively Regularized Gauss Newton Method (IRGNM) in its classical Tikhonov version and in the IRGM Ivanov version under a tangential cone condition in Banach space setting. Convergence without source conditions has so far only been proven under stronger restrictions on the nonlinearity of the operator and/or the spaces. I will also present how to obtain the a posteriori estimates and to achieve the prescribed accuracy by adaptive discretization using goal oriented error estimators. Such problems play a crucial role in numerous applications, ranging from medical imaging via nondestructive testing (e.g. electrical impedancy tomography) to geophysical prospecting (e.g. inverse water ground filtration), with the Banach space setting assigned by the inherent regularity of the sought coefficients as well as structural features such as sparsity.