Verification of variational source conditions

Thorsten Hohage

(Georg-August-Universität Göttingen)

Abstract. *Over the last years Variational Source Conditions (VSCs) have become a standard assumption for the analysis of variational regularization methods. Compared to spectral source conditions they have a number of advantages: They can be used for general non-quadratic penalty and data fidelity terms, lead to simpler proofs, are often not only sufficient, but even necessary for certain convergence rates, and they do not involve the derivative of the forward operator (and hence do not require restrictive assumptions such as a tangential cone condition). However, so far only few sufficient conditions for VSCs for specific inverse problems are known.*

To overcome this drawback, we propose a general strategy for the verification of VSCs, which consists of two sufficient conditions: One of them describes the smoothness of the solution, and the other one the degree of ill-posedness of the operator. For a number of important linear inverse problems this leads to equivalent characterizations of VSCs in terms of Besov spaces and necessary and sufficient conditions for rates of convergence. We also discuss the application of our strategy to nonlinear parameter identification and inverse medium scattering problems where it provides sufficient conditions for VSCs in terms of standard function spaces.