Noise Models for Inverse Problems and Moment Discretization

Zuhair Nashed

Department of Mathematics
University of Central Florida, Orlando, Florida, USA
M.Nashed@ucf.edu

ABSTRACT

The standard view of noise in ill-posed inverse problems is that it is either deterministic and small (strongly bounded noise) or random and large (not necessarily small). A new noise model was recently proposed and investigated by Eggermont et al. (see [1] and [2]), wherein the noise is weakly bounded. Roughly speaking, this means that the "local averages" of the noise are small. In this talk we describe the mathematical setting of this approach and give a precise formulation in a Hilbert space setting. We summarize an analysis of Tikhonov regularization of ill-posed problems with weakly bounded noise, and show that the noise model is particularly appropriate in the regularization of an operator equation or a variational inequality by perturbation (often called Lavrentiev regularization).
The setting includes potential and quasi-potential operators, inverse monotone operators, and moment discretization problems, such as those that arise in geophysical and other inverse problemswhen the data are available at a discrete set of points.

[1] P. P. B. Eggermont, V. N. LaRiiccia and M. Z. Nashed, On weakly bounded noise in ill-posed problems, Inverse Problems 25 (2009): 115018 (14 pages)
[2] ---, Noise Models for Ill-Posed Problems, in "Handbook of Geomathematics" (W. Freeden, M. Z. Nashed and T. Sonar, Eds.", pages 741-762, Springer-Verlag, 2010.
[3] ---, Moment discretization for ill-posed problems with discrete weakly bounded noise, GEM: International Journal on Geomathematics, 3 (2012), published online: 9 April 2012.