



# FLorence OPTimization talkS

Organized by

(NODA) Numerical Optimization and Data Analysis group (DIEF)  
(GOL) Global Optimization Laboratory (DINFO)  
University of Florence

December 11th 2025

**Simone Rebegoldi**

RTDb at UNIMORE

**Time&Location: 11:15 a.m. – Room 007 – CDD Morgagni**

**Title: *On the convergence and stability of multiscale decompositions for imaging inverse problems***

**Abstract:** In this talk, we are interested in the multiscale decomposition for inverse problems devised by Modin, Nachman and Rondi, Adv. Math. (2019), which was itself inspired by the multiscale decomposition of images introduced by Tadmor, Nezzar and Vese, Multiscale Model. Simul. (2004) and based on the classical ROF model for denoising. We investigate the convergence of the iterates sequence in the unknowns space without using the tighter multiscale procedure from the same paper. Particularly, we prove that convergence (up to a subsequence) is achieved for linear inverse problems when the regularization is given by the norm of a Hilbert space. Moreover, in this setting, we theoretically observe that the multiscale procedure improves the stability of the reconstruction. On the other hand, the classical multiscale procedure may fail to convergence even for the linear case with a Banach norm as regularization. Finally, we report a numerical illustration on a linear image deblurring problem, showing that the multiscale procedure improves the stability of the reconstruction with respect to a single-step regularization procedure.