Projection in negative norms and the regularization of rough linear functionals

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Rough linear functionals (such as Dirac Delta distributions) often appear on the right-hand side of variational formulations of PDEs. As they live in negative Sobolev spaces, they dramatically affect adaptive finite element procedures to approximate the solution of a given PDE.

In this talk, we propose an alternative that, in a first step, computes a projection of the rough functional over piecewise polynomial spaces, up to a given desired precision in a negative norm sense. The projection (being Lp-regular) can be used as the right-hand side of a regularized problem for which adaptive Galerkin methods perform better. A complete error analysis of the proposed methodology will be shown, together with numerical experiments.