Adaptive finite element approximations for the elliptic problems using regularized forcing data

Luca Heltai[1] and Wenyu Lei[2]

[1] Mathematics Area, SISSA–International School for Advanced Studies, Via Bonomea 265, 34136, Trieste, Italy, luca.heltai@sissa.it
[2] Mathematics Area, SISSA–International School for Advanced Studies, Via Bonomea 265, 34136, Trieste, Italy, wenyu.lei@sissa.it

Keywords: *Finite elements, interface problems, immersed boundary method, Dirac delta approximations, a posteriori error estimates, adaptivity*

Approximations of the Dirac delta distribution are commonly used to create a sequence of smooth functions approximating nonsmooth (generalized) functions, via convolution. In this talk, we discuss how we use this technique to develop an adaptive finite element algorithm to approximate elliptic problems containing a singular forcing data defined on a closed codimension-one surface. We show that the H^1 error decay against the number of degrees of freedom is quasi-optimal in two dimensional space and sub-optimal in three dimensional space. Numerical examples are provided to confirm our findings.

REFERENCES

[1] Heltai, L. and Lei, W.. A priori error estimates of regularized elliptic problems. *Numer. Math.*, 146(3):571–596.

[2] Heltai, L. and Lei, W.. Adaptive finite element approximations for elliptic problems using regularized forcing data. *arXiv preprint arXiv:2110.15029.*