A pollution-free ultra-weak FOSLS discretization of the Helmholtz equation

Harald Monsuur[1] Rob Stevenson[2]

We consider an ultra-weak first order system discretization of the Helmholtz equation. By employing the optimal test norm, the 'ideal' method yields the best approximation to the pair of the Helmholtz solution and its scaled gradient w.r.t. the norm on $L_2(\Omega)\times L_2(\Omega)^d$ from the selected finite element trial space. On convex polygons, the 'practical', implementable method is shown to be pollution-free when the polynomial degree of the finite element test space grows proportionally with $\log\kappa$. Numerical results also on other domains show a much better accuracy than for the Galerkin method.

References:

[1] https://arxiv.org/abs/2303.16508

[1]Universiteit van Amsterdam
harald.monsuur@hotmail.com

[2]Universiteit van Amsterdam
r.p.stevenson@uva.nl