An introduction to virtual element methods for the Helmholtz problem

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The numerical approximation of time-harmonic wave propagation problems, such as the Helmholtz problem, presents intrinsic difficulties due to the oscillatory nature of analytical solutions. Standard (polynomial-based) Galerkin finite element methods deliver accurate approximation only at very high cost. Therefore, for these problems, finite element methods based on incorporating a priori knowledge about the differential problem to be discretized into the local approximating spaces have become increasingly popular. Finite element-type schemes having the feature that their test and trial functions are (locally) solutions to the targeted differential equation are known in literature as 'Trefftz methods', and functions lying in the kernel of the corresponding differential operator as 'Trefftz functions'. In this talk, we discuss how this Trefftz setting can be embedded in the recently introduced virtual element framework for general polygonal meshes by giving an overview of the state-of-the-art. Both theoretical and numerical results are presented

Keywords:

Galerkin Method • Virtual Element Method • Helmholtz problem • polygonal meshes

"Obvious" is the most dangerous word in mathematics.
- Eric Temple Bell