# A PLANE WAVE VIRTUAL ELEMENT METHOD FOR THE HELMHOLTZ PROBLEM

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Concerned with the time-harmonic wave propagation governed by the Helmholtz equation, we present a novel Galerkin approximation that can deal with general polygonal partitions. Virtual element methods have been recently introduced as extension of finite elements to general polygonal decompositions for different classes of definite and semidefinite problems. Here we design and analyse a method for an indefinite problem.

Because of the oscillatory behavior of solutions to the Helmholtz equation, methods that incorporate information about the solution in the form of plane waves have received attention in the last years. The method presented here is based on inserting plane wave basis functions within the VEM framework aiming at constructing an H1- conforming, high-order method.

The main ingredients of this plane wave-VEM (PW-VEM) are: *i)* a low frequency space made of VEM functions, whose basis functions are not explicitly computed in the element interiors; *ii)* a proper local projection operator onto the high-frequency space, made of plane waves; *iii)* an approximate stabilization term. Convergence of the $h$-version of the PW-VEM is given and numerical results testing its performance on general polygonal meshes are presented.

Alternative choices of the projector operator and of the stabilization term will be discussed.

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