BDDC preconditioners for virtual element discretizations of the Stokes equations

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The balancing domain decomposition by constraints (BDDC) preconditioners are domain decomposition methods based on the subdivision of the computational domain of partial differential equations (PDEs) into non-overlapping subdomains. BDDC methods represent an evolution of balancing Neumann-Neumann methods, that have been used extensively in the past to solve large scale finite element problems. In our work, we apply BDDC to solve PDEs where the space discretization is performed by virtual element methods (VEM), a new family of methods introduced in 2013, which could be considered as a generalization of finite element methods to arbitrary element-geometry. The advantage of these methods is that we can apply them on a wide choice of general polygonal meshes without integrating complex non-polinomial functions on the elements, keeping a high degree of accuracy. Here we present a BDDC algorithm to solve the Schur complement system obtained from a recent divergence free VEM discretization of the two-dimensional Stokes equations. Firstly, we briefly present the VEM mathematical framework, then we analyze theoretically the convergence of the proposed BDDC preconditioners and finally we report some computational results that validate the theoretical estimates.