

# VIRTUAL DISCRETIZATION OF A CONTROL CONSTRAINED DIRICHLET BOUNDARY CONTROL PROBLEM GOVERNED BY THE DIFFUSION PROBLEM

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## ABSTRACT

Optimal control problems governed by Dirichlet boundary control play an essential role in applied sciences and engineering. For example, in computational fluid mechanics, boundary velocity control of incompressible flow which minimizes the viscous drag of an aerodynamic body moving at uniform velocity [1]. Recently, an adaptive Virtual Element Method (VEM) along with variational discretization of control has been developed in the context of distributed control in [2].

We develop a conforming VEM [3] for control constrained Dirichlet boundary optimal control problem governed by the Diffusion problem. An energy-based cost functional is used to approximate the boundary control problem. We use the VEM to discretize the control, state, and adjoint variables. A discretize-then-optimize approach which leads to a stabilized variational inequality, is used to compute the optimal control. A new framework for the a priori error analysis is presented, which is optimal up to the regularity of the continuous solution. A primal-dual algorithm is used to solve the Dirichlet optimal control problem, and numerical experiments are conducted to illustrate the theoretical findings and robustness of the method on general polygonal meshes.

## REFERENCES

- [1] M.D. Gunzburger, L. Hou, T.P. Svobodny. *Boundary velocity control of incompressible flow with an application to viscous drag reduction*, SIAM journal on control and optimization, 30 (1992), 167–181.
- [2] W. Qiming, Z. Zhou. *Adaptive virtual element method for optimal control problem governed by general elliptic equation*, Journal of Sci. Comput. 99 (2021), 1–33.
- [3] S.C. Brenner, Q. Guan, L.Y. Sung. *Some estimates for virtual element methods*, Comput. Methods in Appl. Math. 17 (2017), 553–574.

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