ADAPTIVE VIRTUAL ELEMENT METHODS: CONVERGENCE AND OPTIMALITY

LOURENCO BEIRÃO DA VEIGA, CLAUDIO CANUTO, RICARDO H. NOCHETTO, GIUSEPPE VACCA, AND MARCO VERANI

Abstract. We design an adaptive virtual element method (AVEM) of lowest order over non-conforming triangular meshes with hanging nodes in 2d, which are treated as polygons. The proposed AVEM [?] concatenates two modules, `GALERKIN` and `DATA`. The former deals with piecewise constant data and is shown to be a contraction between consecutive iterates. The latter approximates general data by piecewise constants to a desired accuracy. AVEM hinges on the stabilization-free a posteriori error estimators derived in [?]. We show that AVEM is convergent and quasi-optimal, in terms of error decay versus degrees of freedom, for solutions and data belonging to appropriate approximation classes.

Keywords: virtual element method, nonconforming meshes, a posteriori error analysis, stabilization

Mathematics Subject Classifications (2010): 65N30, 65N50

References

[1] A. Cangiani, E. H. Georgoulis, T. Pryer, and O. J. Sutton. A posteriori error estimates for the virtual element method. Numer. Math., 137(4):857-893, 2017.

[2] L. Beirão da Veiga, C. Canuto, R. H. Nochetto, G. Vacca, M. Verani, Adaptive VEM: Stabilization-Free A Posteriori Error Analysis. SIAM J. Numer. Anal., 61(2):399-494 (2023).

[3] L. Beirão da Veiga, C. Canuto, R. H. Nochetto, G. Vacca, M. Verani, Adaptive VEM for variable data: convergence and optimality. Submitted (2023).

Dipartimento di Matematica e Applicazioni, Università degli Studi di Milano Bicocca, Via Roberto Cozzi 55 - 20125 Milano, Italy
Email address: lourenco.beirao@unimib.it

Dipartimento di Scienze Matematiche G.L. Lagrange, Politecnico di Torino, Corso Duca degli Abruzzi 24 - 10129 Torino, Italy
Email address: claudio.canuto@polito.it

Department of Mathematics and Institute for Physical Science and Technology, University of Maryland, College Park - 20742, MD, USA
Email address: rhn@math.umd.edu

Dipartimento di Matematica, Università degli Studi di Bari, Via Edoardo Orabona 4 - 70125 Bari, Italy
Email address: giuseppe.vacca@uniba.it

MOX-Laboratory for Modeling and Scientific Computing, Dipartimento di Matematica, Politecnico di Milano, Piazza Leonardo da Vinci 32 - 20133 Milano, Italy
Email address: marco.verani@polimi.it