## A VARIATIONAL MULTISCALE APPROACH FOR ERROR ESTIMATION IN ADAPTIVE ISOGEOMETRIC ANALYSIS

\*Department of Mathematical Sciences, Norwegian University of Science and Technology, N-7491 Trondheim, Norway e-mail: Mukesh.Kumar@math.ntnu.no, Trond.Kvamsdal@math.ntnu.no, Kjetil.Andre.Johannessen@math.ntnu.no

<sup>†</sup>Department of Applied Mathematics, SINTEF ICT, N-7465 Trondheim, Norway e-mail: Arne.Morten.Kvarving@sintef.no, Knut.Morten.Okstad@sintef.no

**Key words:** Isogeometric analysis, NURBS, A posteriori error estimation, Fluid dynamics, Variational multiscale method, Adapted methods.

Abstract. In this work, we present an explicit a-posteriori error estimator in isogeometric analysis for fluid dynamics problem like advection-diffusion equations. The technique is based on the theortical framework of the variational multiscale (VMS) method [1] and recently derived explicit formula of the fine-scale Green's function [2]. This technique is adequate for the methods with a local error distribution, such as stabilized methods, where the element local problem captures most of the error and the proposed error intrinsic parameter is an approximation to the solution of the dual problem. The proposed technique can be implemented straightforwardly in existing codes and is computationally efficient. We consider different test examples to show the robustness and effectivitness of this technique as a posteriori error estimator in isogeometric analysis.

## REFERENCES

- T. J. R. Hughes, Multiscale phenomena: Green's functions, the Dirichlet-to-Neumann formulation, subgrid scale models, bubbles and the origins of stabilized methods, *Computer Methods in Applied Mechanics and Engineering*, 127(1995), 387-401.
- [2] T. J. R. Hughes, G. Sangalli, Variational multiscale analysis: the fine-scale Green's function, projection, optimization, localization, and stabilized methods, SIAM Journal on Numerical Analysis, 45(2)(2007), 539-557.