**Maxwell Compactness for Polytopal Methods**

Simon Lemaire

INRIA, Univ. Lille, France
SIMON.LEMAIRE@INRIA.FR

**Abstract**

Real-world, coupled and multiphysics problems are often nonlinear. As such, their analysis (existence of solutions to the PDE model, convergence of numerical approximations) often relies on compactness arguments.

At the continuous level, for PDE models based on the de Rham complex, these compactness results are well established, and due to Rellich (for $H^1$) and to Weck/Weber (for $\boldsymbol{H}(\mathbf{curl})$ and $\boldsymbol{H}(\mathrm{div})$). The last two results are often referred to, in the literature, as Maxwell compactness, as they naturally appear in the study of models in electromagnetism.

At the discrete level, even for conforming finite element approximations on standard meshes, Maxwell compactness results do not directly follow from their infinite-dimensional counterpart. This is even more true for polytopal methods, which hinge on fully algebraic spaces and discrete operator and potential reconstructions.

In this talk, we will discuss Maxwell compactness results in the case of two different polytopal methods, namely the HHO (Hybrid High-Order) and the DDR (Discrete De Rham) approaches. The former is non-conforming and non-compatible, whereas the latter is conforming (in a sense that will be made precise) and compatible.

The material of this talk is based on joint works (i) with S. Pitassi (Univ. Montpellier) on the one hand [1], and (ii) with T. Chaumont-Frelet (INRIA Lille) and J. Droniou (CNRS, Univ. Montpellier) on the other hand [2].

# References

[1] S. Lemaire and S. Pitassi. *Discrete Weber inequalities and related Maxwell compactness for hybrid spaces over polyhedral partitions of domains with general topology*, Found. Comput. Math., 25(3) (2025), 725–763.

[2] T. Chaumont-Frelet, J. Droniou, and S. Lemaire. *Commuting quasi-interpolators and Maxwell compactness for a polytopal de Rham complex.* Preprint `arXiv:2510.18835`, Oct. 2025.