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H^1-CONFORMING FINITE ELEMENT COCHAIN COMPLEXES ON CARTESIAN MESHES

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In recent years considerable effort was put into the development of H^1-conforming methods with exact divergence constrain in two and three dimensions. This talk, instead, is concerned with the full finite element cochain complex.

The starting point is the one-dimensional H^1-conforming finite element cochain complex based on cubic polynomials with Hermitian interpolation. Based on the tensor product construction, we obtain H^1-conforming finite element spaces V^k on Cartesian meshes of arbitrary order n. In particular, for each finite element form $u_h \in V^k \subset H^1\Lambda^k$, its exterior derivative fulfills $du_h \in V^{k+1} \subset H^1\Lambda^{k+1}$.

Moreover, commuting interpolation operators for differentiable functions as well as commuting quasi-interpolation operators that are continuous in L^2 are provided.

The construction of the H^1-conforming finite element cochain complex and the corresponding commuting quasi-interpolation operators is then extended to higher order polynomial spaces.

REFERENCES

[1] F. Bonizzoni and G. Kanschat, H1-conforming finite element cochain complexes and commuting quasi-interpolation operators on cartesian meshes. *Calcolo*, Vol.**58**(18), 2021.