

COCHAIN DISCRETIZATIONS OF PDE PROBLEMS

Franco Brezzi

IUSS
Lungo Ticino Sforza 56,
Pavia (Italy)
brezzi@imati.cnr.it
<http://www.imati.cnr.it/brezzi>

Key Words: *Mimetic Finite Differences, Co-chains, Discretization of differential forms .*

ABSTRACT

We shall survey some recent results in the use of the so-called Mimetic Finite Differences. Our approach aims at presenting them as discretizations of Differential Forms made using Co-chains on very general decompositions. We will shall briefly see the basic ideas behind the co-chain discretizations of all types of differential forms (in three dimensions) using model problems based on both classical and mixed formulations. We shall underline the reasons why, in our opinion, the Mimetic Finite Difference approach could be very effective in dealing with multiscale problems. Finally we shall discuss some pros and cons of the combination of stabilization techniques and MFD

REFERENCES

- [1] F. Brezzi, A. Buffa. “ Innovative mimetic discretizations for electromagnetic problems”, submitted.
- [2] F. Brezzi, A. Buffa “ Scalar products of discrete differential forms”, in preparation
- [3] F. Brezzi, A. Buffa , and M. Shashkov “Mimetic finite differences for elliptic problems”. Submitted
- [4] F. Brezzi, K. Lipnikov, and M. Shashkov “ Convergence of Mimetic Finite Difference Methods for Diffusion Problems on Polyhedral Meshes”, SIAM J. Num. Anal , 43 (2005), 1872-1896
- [5] F. Brezzi, K. Lipnikov, M. Shashkov “Convergence of Mimetic Finite Difference Methods for Diffusion Problems on Polyhedral Meshes with curved faces”, Math. Models Methods Appl. Sci. 16 (2006), 275-298
- [6] F. Brezzi, K. Lipnikov, M. Shashkov, V. Simoncini “ A new discretization methodology for Diffusion Problems on generalized polyhedral meshes”, Comput. Methods Appl. Mech. Engrg. 196, (2007), 3682-3692.
- [7] F. Brezzi, K. Lipnikov, and V. Simoncini “ A family of mimetic finite difference methods on polygonal and polyhedral meshes”, Math. Models Methods Appl. Sci. 15 (2005), 1533-1553