New Crouzeix-Raviart spaces of even and variable order

Marialetizia Mosconi[1]   Andrea Bressan[2]   Lorenzo Mascotto[3]

The lowest-order Crouzeix–Raviart (CR) element was introduced in 1973 by Crouzeix and Raviart as an elementwise divergence free discretization of the Stokes' equations for space dimensions $d = 2, 3$; The design of CR-type elements of higher polynomial degree p, reveals that their definitions must differ with respect to the parity of p. In this talk, we present new CR-type spaces of even degree p that are spanned by basis functions mimicking those for the standard odd degree case. Compared to the standard even order CR gospel, the present construction allows for the use of nested bases of increasing degree and is particularly suited to design variable order CR methods. We analyze a nonconforming discretization of a two dimensional Poisson problem, which requires a DG-type stabilization. Numerical results are presented, which exhibit the expected convergence rates for the h- and p-versions of the scheme. Finally, the design of variable degree CR global spaces and a corresponding variable order method are discussed.

[1]University of Milano Bicocca, Department of Mathematics and Applications
  m.mosconi@campus.unimib.it

[2]IMATI CNR, Pavia
  andrea.bressan@imati.cnr.it

[3]University of Milano Bicocca, Department of Mathematics and Applications, Milan
  lorenzo.mascotto@unimib.it