

Report on Special Semester

Joachim Schöberl

- High order Finite Elements
- Mixed Finite Element Methods
- PML - Absorbing layers

High Order Finite Elements

Block Lecture: Alexander Düster

Mini-workshop: hp-Finite Elements

Guests: Leszek Demkowicz, Jay Gopalakrishnan, Markus Melenk

High Order Finite Elements : New Results

L. Demkowicz, J. Gopalakrishnan, J. Schöberl:

Optimal p -extension operators for $H(\text{curl})$ and $H(\text{div})$

Important for hp-FEM analysis for mixed methods and Maxwell equations.

A priori estimates, preconditioning, a posteriori, ...

Mixed Finite Element Methods

Lecture: Dietrich Braess

2 Sessions on International Workshop DIFCOME

Guests: Stenberg, Bischoff, Winther, Ainsworth, Bertoti, ...

Mixed Methods : Results

D. Braess, J. Schöberl:

Equilibrated Residual error estimates for Maxwell Equations

Scalar equation:

$$\|\nabla(u - u_h)\|_{L_2} \leq \inf_y \{ \|\nabla u - y\|_{L_2} + c_F \|\operatorname{div} y + f\|_{L_2} \}$$

Cheap equilibration procedure achieves $\operatorname{div} y + f = 0$

Maxwell equation:

$$\operatorname{curl} \mu^{-1} \operatorname{curl} A = j$$

Postprocessing:

$$H_h = \mu^{-1} \operatorname{curl} A_h \Rightarrow \tilde{H}_h$$

such that

$$\operatorname{curl} \tilde{H}_h = j$$

Mixed Methods : Results

J. Schöberl: New mixed finite element for elasticity

J. Schöberl, V. Havu: Mixed elements for hierarchic shell models

Other main activity:

Mixed methods for KKT systems

PML - absorbing layers

Seminar: James Bramble

Club: M. Ainsworth, J. Bramble, T. Hohage, M. Kaltenbacher, J. Pasciak, M. Rechberger, J. Schöberl

Paper: M. Ainsworth, M. Rechberger, J. Schöberl:
Finite element projection methods for perfectly matched layers.