New shape functions for triangular p-FEM using integrated Jacobi polynomials

Sven Beuchler[1] Joachim Schoeberl[2]

In this talk, the second order boundary value problem $-\nabla \cdot (\mathcal{A}(x,y)\nabla u) = f$ is discretized by the Finite Element Method using piecewise polynomial functions of degree p on a triangular mesh. On the reference element, we define integrated Jacobi polynomials as interior ansatz functions. If $\mathcal{A}$ is a constant function on each triangle and each triangle has straight edges, we are able to show that the element stiffness matrix has not more than $25/2p^2$ nonzero matrix entries.

The proof of this result requires several properties of Jacobi polynomials. We will present the most important relations for Jacobi polynomials which are needed.

Finally, two applications of this result are presented.

[1]Kepler-University Linz, Institute of Computational Mathematics, Altenberger Strasse 69, 4040 Linz-Auhof, Austria,
sven.beuchler@numa.uni-linz.ac.at
[2]Johann Radon Institute for Computational and Applied Mathematics, Austrian Academy of Sciences, Altenberger Strasse 69, 4040 Linz-Auhof, Austria,
joachim.schoeberl@oeaw.ac.at