

Symbolic evaluation of hp -FEM element matrices on simplices

12.03**Tim Haubold***(University of Hannover, Germany)***Time:** Monday 22.07., 11:30 - 12:00, Room HS 6

Abstract: In this talk we consider high-order finite element discretizations of linear elliptic boundary value problems. Following e.g. [1,2] a set of hierarchic basis functions on simplices is chosen. For an affine simplicial triangulation this leads to a sparse stiffness matrix. Moreover the L_2 -inner product of the interior basis functions is sparse with respect to the polynomial order p . The construction relies on a tensor-product based construction with properly weighted Jacobi polynomials.

In this talk we present algorithms which compute the remaining non zero entries of mass- and stiffness matrix in optimal arithmetical complexity. In order to obtain this result, recursion formulas based on symbolic methods [3] are used. The presented techniques can be applied not only to scalar elliptic problems in H^1 but also for vector valued problems in $H(\text{div})$ and $H(\text{curl})$, where an explicit splitting of the higher-order basis functions into solenoidal and non-solenoidal ones is used.

- [1] Beuchler, Pillwein, Schöberl, Zaglmayr: *Sparsity Optimized High Order Finite Element Functions on Simplices*, 2012.
- [2] Karniadakis, Sherwin: *Spectral/HP Element Methods for CFD*, 1999.
- [3] Kauers: *SumCracker – A Package for Manipulating Symbolic Sums and Related Objects*, 2006.