# DK Seminar

**November 5, 2014**
**TU, SEM 101C, 13:45 - 15:00**


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## Optimality of Adaptive Algorithms and the LU-Factorization of Matrices


**Abstract:** The $LU$-factorization of matrices is well-known. Let $A \in \mathbb{R}^{n\times n}$ be a matrix with regular submatrices $A|_{(1,\dots,k)\times(1,\dots,k)}$ for all $1 \le k \le n$, there exists an upper triangular matrix $U \in \mathbb{R}^{n\times n}$ and a lower triangular matrix $L \in \mathbb{R}^{n\times n}$ such that

$$A = LU \quad \text{and} \quad L_{jj} = 1 \text{ for all } 1 \le j \le n.$$

If $A$ is symmetric and elliptic, i.e.,

$$A^T = A \quad \text{and} \quad C_A(Ax \cdot x) \ge \|x\|_{\ell^2}^2 := \sum_{j=1}^{n} x_j^2 \text{ for all } x \in \mathbb{R}^n,$$

there exists a Cholesky factorization $A = LL^T$ with lower triangular $L \in \mathbb{R}^{n\times n}$ and $L$ satisfies

$$\|L\|_2 \le \|A\|_2 \quad \text{as well as} \quad \|L^{-1}\|_2 \le C_A.$$

The question is, whether for non-symmetric but elliptic $A \in \mathbb{R}^{n\times n}$ the term

$$\|L\|_2 + \|L^{-1}\|_2$$

is bounded in any dimension independent way. The talk considers the strong connection of this question to the optimal convergence of adaptive algorithms for non-symmetric Galerkin procedures and provides some initial answers.