**There is no face-to-face partition of $R^5$ into acute simplices**

Michal Křížek

Mathematical Institute, Academy of Sciences, Žitná 25
CZ-115 67 Prague 1, Czech Republic, e-mail: krizek@math.cas.cz

*Abstract.* We prove that a point in the Euclidean space $R^5$ cannot be surrounded by a finite number of acute simplices. This fact implies that there does not exist a face-to-face partition of $R^5$ into acute simplices. The existence of an acute simplicial partition of $R^d$ for $d > 5$ is excluded by induction, but for $d = 4$ this is an open problem (see [1]).

Acute simplicial partitions are very useful in numerical analysis, since they yield irreducible and diagonally dominant stiffness matrices, when solving the equation

$$-\Delta u + bu = f$$

by standard linear conforming finite elements in a bounded polytopic domain in $R^d$ with some boundary conditions and $b \geq 0$ small enough. In this case the discrete maximum principle takes place, see [2] and [3]. The necessity of solving partial differential equations for dimensions $d > 3$ arises in statistical physics, financial mathematics, general relativity, particle physics, etc.

## References

[1] M. Křížek, *There is no a face-to-face partition of $R^5$ into acute simplices*, accepted by Discrete Comput. Geom. in 2006, 1–8.

[2] S. Korotov, M. Křížek, *Acute type refinements of tetrahedral partitions of polyhedral domains*, SIAM J. Numer. Anal. **39** (2001), 724–733.

[3] S. Korotov, M. Křížek, *Global and local refinement techniques yielding nonobtuse tetrahedral partitions*, Comput. Math. Appl. **50** (2005), 1105–1113.