

Geometry Seminar
Tuesday, January 13, 2009
Room 317 WWH at 6:00 P.M.

Hardness of embedding simplicial complexes in \mathbb{R}^d

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Let $\text{EMBED}_{k \rightarrow d}$ be the following algorithmic problem: Given a finite simplicial complex K of dimension at most k , does there exist a (piecewise linear) embedding of K into \mathbb{R}^d ? Known results easily imply polynomiality of $\text{EMBED}_{k \rightarrow 2}$ ($k = 1, 2$; the case $k = 1, d = 2$ is graph planarity) and of $\text{EMBED}_{k \rightarrow 2k}$ for all $k \geq 3$ (even if k is not considered fixed).

The main result presented in the talk is NP-hardness of $\text{EMBED}_{2 \rightarrow 4}$ and, more generally, of $\text{EMBED}_{k \rightarrow d}$ for all k, d with $d \geq 4$ and $d \geq k \geq (2d - 2)/3$. We also show that the celebrated result of Novikov on the algorithmic unsolvability of recognizing the 5-sphere implies that $\text{EMBED}_{d \rightarrow d}$ and $\text{EMBED}_{(d-1) \rightarrow d}$ are undecidable for each $d \geq 5$.

For more information please visit the seminar website at:
http://www.math.nyu.edu/seminars/geometry_seminar.html.