How Can Computational Geometry Matter to Computer Graphics?

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Abstract

Although data structures from computational geometry are often of interest in computer graphics, deep results from computational geometry are rarely used. There are several reasons: often the constants in the $O(\ldots)$ are too large, often the results are so complex that they remain unimplemented, and often the results depend on a model of computation – that there are actually real numbers to be computed with – that's simply inaccurate and leads to horrid results when the algorithms are carelessly implemented with floating-point computations.

In this talk, I'll survey some work (almost none of it my own) that seems to have a real relevance to some problems in computer graphics, and discuss some work that could be done to really make a different in various areas of graphics. These include visibility detection, intersection testing heuristics, and "approximate-but-stable" algorithms for various standard computational geometry tools. I'll also discuss some characteristics of the current challenges of computer graphics – especially the importance of smoothly degradable computation, and of frame-to-frame coherence for animation – and their implications.

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