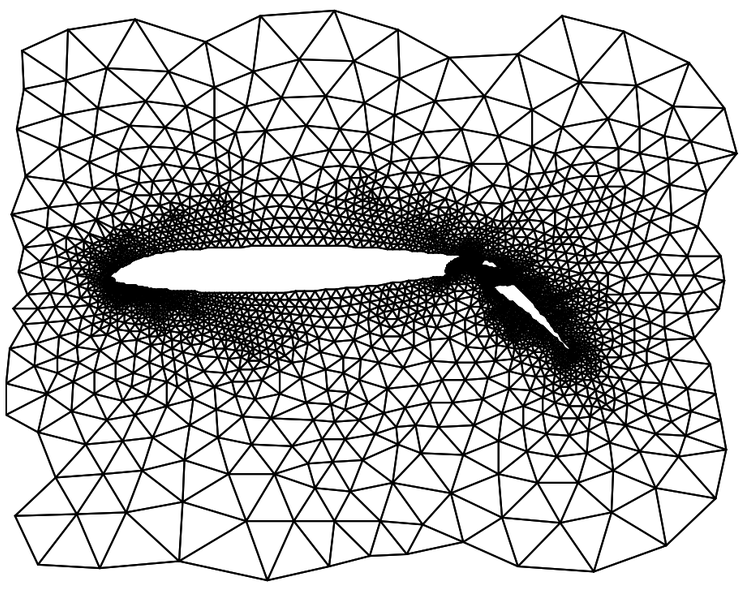
Berlin Mathematical School

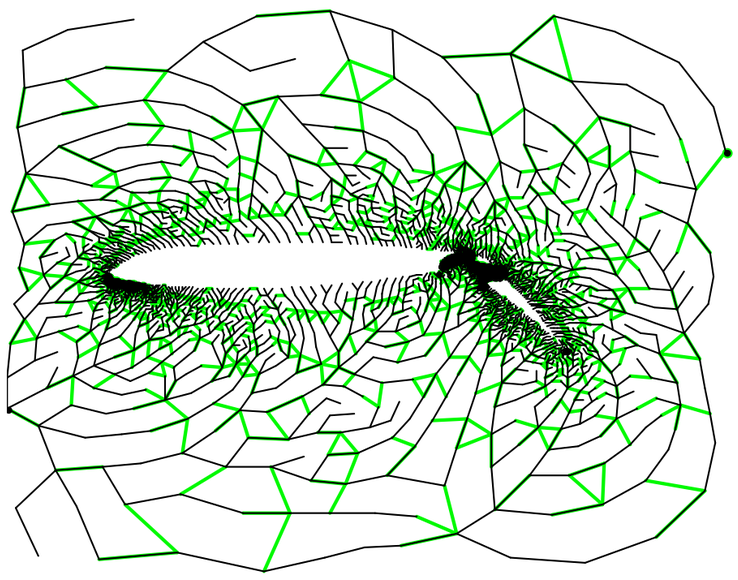
BMS Friday Colloquium

Friday 13 May 2011 at 14:15

Tea before the lecture begins at 13:00

BMS Loft, Urania, An der Urania 17, 10787 Berlin





Dan Spielman

(Yale University)

Approximating Graphs and Solving Systems of Linear Equations

The problem of designing fast algorithms for solving systems of linear equations is connected to a surprising number of areas of mathematics.

In this talk, Dan Spielman surveys recent progress in algorithms for solving linear equations in the Laplacian matrices of graphs. These algorithms motivate and rely upon other fascinating primitives in graph theory. Most importantly, they motivate a definition of what it means for one graph to approximate another. This definition leads to the problem of sparsification - approximating one graph by a sparser graph.

The sparsest possible approximation of a graph is a spanning tree. The average stretch of a spanning tree will be revealed to be a good measure of its approximation quality. We explain how every graph on n vertices can be well-approximated by a graph with O (n) edges. To solve linear equations, we will require something in between: approximations by graphs with n + O (n / log n) vertices. To build these sparse approximations, we employ low-stretch spanning trees, random matrix theory, spectral graph theory, and graph partitioning algorithms.

Dan Spielman is professor of Applied Mathematics and Computer Science at Yale University since 2006. He received his B.A. in mathematics and computer science from Yale University in 1992 and his Ph.D. in applied mathematics from MIT in 1995. In 2008, he was awarded the Gödel Prize for his joint work on smoothed analysis of algorithms. In 2010, he was awarded the Nevanlinna Prize for "smoothed analysis of Linear Programming, algorithms for graph-based codes and applications of graph theory to Numerical Computing" and the same year he was named a Fellow of the Association for Computing Machinery. He holds several patents in the area of coding theory with the U.S. Patent Office.

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