

**The Weizmann Institute of Science
Faculty of Mathematics and Computer Science**

Foundations of Computer Science Seminar

Lecture Hall - Room 1, Ziskind Building
on Monday, May 11, 2026
at 11:15

Uri Zwick
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will speak on

Improved Approximation Algorithms for the Multiway Cut problem

Abstract:

The input to the Multiway Cut problem is a weighted undirected graph, with nonnegative edge weights, and k designated terminals. The goal is to partition the vertices of the graph into k parts, each containing exactly one of the terminals, such that the sum of weights of the edges connecting vertices in different parts of the partition is minimized. The problem is APX-hard for $k \geq 3$. The currently best-known approximation algorithm for the problem for arbitrary k , obtained by Sharma and Vondrák [STOC 2014] more than a decade ago, has an approximation ratio of 1.2965. We present an algorithm with an improved approximation ratio of 1.2787. Also, for small values of $k \geq 4$ we obtain the first improvements in 25 years over the currently best approximation ratios obtained by Karger, Klein, Stein, Thorup, and Young [STOC 1999]. (For $k = 3$ an optimal approximation algorithm is known.)

Our main technical contributions are new insights on rounding the LP relaxation of Călinescu, Karloff, and Rabani [STOC 1998], whose integrality ratio matches Multiway Cut's approximability ratio, assuming the Unique Games Conjecture [Manokaran, Naor, Raghavendra, and Schwartz, STOC 2008]. First, we introduce a generalized form of a rounding scheme suggested by Kleinberg and Tardos [FOCS 1999] and use it to replace the Exponential Clocks rounding scheme used by Buchbinder, Naor, and Schwartz [STOC 2013] and by Sharma and Vondrák. Second, while previous algorithms use a mixture of two, three, or four basic rounding schemes, each from a different family of rounding schemes, our algorithm uses a computationally-discovered mixture of hundreds of basic rounding schemes, each parametrized by a random variable with a distinct probability distribution, including in particular many different rounding schemes from the same family. We give a completely rigorous analysis of our improved algorithms using a combination of analytical techniques and interval arithmetic.

Joint work with Joshua Brakensiek, Neng Huang and Aaron Potechin.