

AGCO Seminar

Speaker: Felix Hommelsheim, Bremen U., Alemania

Title: Two-Edge Connectivity via Pac-Man Gluing

Abstract:

We study the 2-edge-connected spanning subgraph (2-ECSS) problem: Given a graph G , compute a connected subgraph H of G with the minimum number of edges such that H is spanning, i.e., $V(H) = V(G)$, and H is 2-edge-connected, i.e., H remains connected upon the deletion of any single edge, if such an H exists. The 2-ECSS problem is known to be NP-hard. In this work, we provide a polynomial-time $(5/4 + \epsilon)$ -approximation for the problem for an arbitrarily small $\epsilon > 0$, improving the previous best approximation ratio of $13/10 + \epsilon$.

Our improvement is based on two main innovations: First, we reduce solving the problem on general graphs to solving it on structured graphs with high vertex connectivity. This high vertex connectivity ensures the existence of a 4-matching across any bipartition of the vertex set with at least 10 vertices in each part. Second, we exploit this property in a later gluing step, where isolated 2-edge connected components need to be merged without adding too many edges. Using the 4-matching property, we can repeatedly glue a huge component (containing at least 10 vertices) to other components. This step is reminiscent of the Pac-Man game, where a Pac-Man (a huge component) consumes all the dots (other components) as it moves through a maze. These two innovations lead to a significantly simpler algorithm and analysis for the gluing step compared to the previous best approximation algorithm, which required a long and tedious case analysis.

This is a joint work with Mohit Garg and Alexander Lindermayr. An independent work by Miguel Bosch-Calvo, Fabrizio Grandoni and Afrouz Jabal Ameli obtained essentially the same result. A merge of these two papers will appear at STOC 2025.

When: March 19, 3:00pm.

Where: Sala de Seminario John Von Neumann, 7th floor, CMM, Av. Beauchef 851, torre norte.

