

Geometric Optimization in Wireless Communication and Sensing

Sunday, June 8, Afternoon

Program

14:30–15:10

Shortest Paths in Intersection Graphs of Unit Disks

Sergio Cabello

15:15–15:55

Barriers in Networks: The Good, the Bad and the Ugly

Valentin Polishchuk

16:00–16:30

Coffee break

16:30–17:10

Cooperative Navigation for Robot Swarms

Sándor Fekete

17:15–18:00

Discussion and open problem session

The Organizers

Abstracts

Shortest Paths in Intersection Graphs of Unit Disks

Sergio Cabello

Let G be a unit disk graph in the plane defined by n unit disks whose positions are known. We show that in G a shortest path tree from a given source can be computed in $O(n \log n)$ time in the unweighted case and in $O(n^{1+\epsilon})$ time in the weighted case. As an application of this result, we will discuss how to solve the following problem: given a set of unit disks in the plane and two points s and t , find the minimum number of disks one needs to retain so that any path connecting s to t intersects some of the retained disks.

The presentation is based on joint works with Miha Ježič and Panos Giannopoulos.

Barriers in Networks: The Good, the Bad and the Ugly

Valentin Polishchuk

Raising barriers to accomplish various network-related tasks—intruder detection, communication control, surveillance—has been studied recently in different settings: using circular and line-segment units, designing adversarial schemes and algorithms for the “good-guys”, deploying real and virtual fences, considering static and dynamic models. The talk will survey known results and outline open problems in the area, making connections to classical network notions and their geometric analogues.

Cooperative Navigation for Robot Swarms

Sándor Fekete

In recent years, the field of robotics has achieved progress by increasing the capabilities of individual robots. This has produced good results, but keeps the cost of state-of-art machines relatively high. An alternative approach is to develop simpler, cheaper (and, with additional challenges and possibilities: smaller) platforms in large numbers, at the expense of reducing the capabilities per robot. The latter raises new challenges for the development of new principles and algorithms, such as coordinating many cheap robots with limited capabilities into a swarm that can carry out difficult tasks, such as exploration, surveillance, and guidance. In this talk, we show a number of recent result, many of which are based on a collaboration between theory and practice of swarm robotics. In particular, we consider online problems related to exploring and surveying a region by a swarm of robots with limited capabilities.