Invited talk

Speaker: Magnús M. Halldórsson

Affiliation: Reykjavik University

Title: How well do graphs capture wireless interference?

Abstract: Graphs are fundamental combinatorial objects that capture pairwise relationships between items. They have commonly been used for modeling incompatibilities in network communications.

A key issue in wireless communication is managing interference between simultaneous transmissions. Various formulations have been used to capture this. One model is to deem two transmitters incompatible if their spatial separation is less than a fixed cutoff. This leads to the class of *unit disk graphs* (UDG), for which a large literature now exists. Secondary interference can be caused by two senders simultaneously affecting the same receiver. This has led to the study of, e.g., distance-2 constrained colorings in graphs as well various other classes of graphs generalizing UDG's.

In comparison, the models used by electrical and communication engineers are of quite different nature. The most common is the *signal-to-noise-plus-interference (SINR)* model. This is considered to capture reality more closely, and is in fact also called the physical model. In this model, interference is considered to be *cumulative*, rather than binary, and an *all-to-all* relationship, rather than purely local. As such, it has various curious properties that differ significantly from graph-based models.

The perceived complexity of the model is the main reason why results on mathematical and algorithmic analysis within this model are only recently starting to appear. Yet, as we gain further understanding, the question remains if wireless interference is now permanently lost beyond the grasp of combinatorics. In other words, to which extent can we use graphs in the analysis of wireless interference?

We outline in this talk the essential features of the physical model of wireless interference, and discuss two important scenarios for which graphs capture very well the essential constraints involving the interference.