THE WEIZMANN INSTITUTE OF SCIENCE
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Faculty Seminar

Room 155 ,Ziskind Building
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On Parameterized Analysis and the Disjoint Paths Problem

Abstract:

Parameterized Anaylsis leads both to deeper understanding of intractability results and to practical solutions for many NP-hard problems. Informally speaking, Parameterized Analysis is a mathematical paradigm to answer the following fundamental question: What makes an NP-hard problem hard? Specifically, how do different parameters (being formal quantifications of structure) of an NP-hard problem relate to its inherent difficulty? Can we exploit these relations algorithmically, and to which extent? Over the past three decades, Parameterized Analysis has grown to be a mature field of outstandingly broad scope with significant impact from both theoretical and practical perspectives on computation.

In this talk, I will first give a brief introduction of the field of Parameterized Analysis. Then, I will discuss some recent work in this field, where I mainly address (i) problems at the core of this field, rooted at Graph Minors and Graph Modification Problems, and (ii) applications of tools developed in (i) in particular, and of parameterized analysis in general, to Computational Geometry and Computational Social Choice. Additionally, I will zoom into a specific result, namely, the first single-exponential time parameterized algorithm for the Disjoint Paths problem on planar graphs. An efficient algorithm for the Disjoint Paths problem in general, and on "almost planar" graphs in particular, is a critical part in the quest for the establishment of an Efficient Graph Minors Theory. As the Graph Minors Theory is the origin of Parameterized Analysis and ubiquitous in the design of parameterized algorithms, making this theory efficient is a holy grail in the field.