Emergent Research:
The PIMS Postdoctoral Fellow Seminar

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Non-realizability of Polytopes via linear Programming

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ABSTRACT:
A classical question in polytope theory is whether an abstract polytope can be realized as a concrete convex object. Beyond dimension 3, there seems to be no concise answer to this question in general. In specific instances, answering the question in the negative is often done via "final polynomials" introduced by Bokowski and Sturmfels. This method involves finding a polynomial which, based on the structure of a polytope if realizable, must be simultaneously zero and positive, a clear contradiction. The search space for these polynomials is ideal of Grassmann-Plücker relations, which quickly becomes too large to efficiently search, and in most instances where this technique is used, additional assumptions on the structure of the desired polynomial are necessary.

In this talk, I will describe how by changing the search space, we are able to use linear programming to exhaustively search for similar polynomial certificates of non-realizability without any assumed structure. We will see that, perhaps surprisingly, this elementary strategy yields results that are competitive with more elaborate alternatives and allows us to prove non-realizability of several interesting polytopes.

SPEAKER BIO:
Amy Wiebe received her PhD under the supervision of Rekha Thomas from the University of Washington in 2019. She previously received her B.Sc. and M.Sc. from Simon Fraser University. After finishing her PhD, she was a Dirichlet Postdoctoral Fellow of the Berlin Mathematical School working with the Discrete Geometry group at Freie Universität Berlin. Her recent research is in the area of polyhedral combinatorics with connections to optimization and applied algebraic geometry. She is currently an NSERC/PIMS Postdoctoral Fellow at Simon Fraser University working with Tamon Stephen.

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