

## **Slack variety of a polytope and its applications**

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The slack variety of a polytope is an algebraic model for the realization space of a combinatorial class of a polytope. In short we establish a correspondence between realizations of a given polytope and points in the positive part of a subvariety of a variety of matrices of constrained rank. This allow us to apply the tools of computational algebra to a number of problems in polytope theory. The original motivation for the introduction of this object came from the study of psd-minimality, i.e, the property of a polytope having a semidefinite description of the smallest possible dimension, but it can also be applied to classic questions of realizability.

In this talk we will motivate and define the notion of slack variety and present a few of its original applications. In the last part of the talk, we will present some ongoing work on how to, from this algebraic notion, we can use some nonlinear optimization tools and a sprinkle of statistics to estimate the dimension of the realization space of a polytope, providing us with a non-combinatorial tool to search for evidence to some open questions and conjectures in the polytope literature.

All this is part of several past or ongoing collaborations with subsets of these people:  
Antonio Macchia, Jeffrey Pang, Kanstantsin Pashkovich, Ting Kei Pong, Richard Z. Robinson,  
Rekha Thomas, Amy Wiebe