Student project on a polyhedral approximation of the second-order cone

1 Introduction

In this project, the student will study a remarkable polyhedron. Specifically, for every natural number \( k \), there exists a \( k + 5 \)-dimensional polyhedron with \( 4k + 5 \) facets, which has a two-dimensional linear projection that is a regular \( 2^{k+1} \)-gon. That is an exponential blowup!

This polyhedron was first described by Ben-Tal and Nemirovski in [1], who were interested in its use for approximating second-order conic programs (SOCP) using linear programs. Their construction attains a remarkable accuracy using a very compact formulation. The paper [2] by Glineur improves on the construction and can be used to better understand the construction by Ben-Tal and Nemirovski and also to get a different view on it.

The project is intended for masters students as masters project. By the end of the project, the student is expected to be familiar with the basics of second-order conic programming and extended formulations.

The provided literature for this project is [1] and [2], although the student is expected to find additional literature on their own where appropriate.

References
