symchm

A package for symmetric polyhedral projection

1.0

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Contents

Chapter 1

Introduction

symchm is a GAP package that for projeting polyhedra using Convex Hull Method (chm). The 'sym' prefix follows from the fact that symchm also supports specifying a group of symmetries of the projection polyhedron. Currently, the main supported class of symmetries is the permutations of co-ordinate dimensions under which the projection is known to be fixed (stabilized setwise). The algorithm CHM proceeds by solving a series of linear programs (LPs) over the input polytope P, recovering a vertex of projection per LP solved. It also maintains an inequality description of an inner bound of projection, associated with the convex hull of the subset of vertices found. This description is updated every time a new vertex is found. symchm exploits symmetry in several different ways viz. by solving roughly the number of LPs equal to the number orbits of the symmetry group on vertices of projection and by using symmetric updates of the inequality description. The aforementioned LPs are solved by an external program Qsopt_ex [ACDE09] which is a linear program solver by Applegate,Cook,Dash and Espinoza. symchm uses GAP interface package `qsopt_ex-interface` [Apt15] to talk to Qsopt_ex via standard input-output.

Chapter 2

Installation

Assuming you already have GAP 4.5+ installed, you can follow the steps below to install the package:

- To get the newest version of symchm, download the .zip archive from https://github.com/jayant91089/symchm and unpack it using `unzip symchm-x.y.zip` in the terminal. Do this preferably inside the *pkg* subdirectory of your GAP 4 installation. It creates a subdirectory called `qsopt_ex-interface`. If you do not know the whereabouts of the *pkg* subdirectory, invoke the following in GAP:

Code

```
GAPInfo.("RootPaths");
```

Look for pkg directory inside any of the paths returned.

- Once unpacked in the right directory, one can start using symchm by invoking

Code

```
LoadPackage( "symchm");
```

from within GAP. This will automatically load `qsopt_ex-interface`, if it is available. If instead, it returns 'fail', make sure `qsopt_ex-interface` is installed. See the package manual for `qsopt_ex-interface` for details of how to install it.

References

[ACDE09] David Applegate, William Cook, Sanjeeb Dash, and Daniel Espinoza. QSopt-ex 2.6 — A computer algebra system for polynomial computations, 2009. 3

[Apt15] Jayant Apte. qsopt_ex-interface - An Interface to QSopt exact LP solver -A GAP4 Package, 2015. http://www.ece.drexel.edu/walsh/aspitrg/software.html. 3

Index