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# Cutting planes and infeasibility certificates from lattice-point-free polyhedra

Quentin Louveaux  
*CORE*  
*Université Catholique de Louvain*  
*Voie du Roman Pays, 34*  
*Louvain-la-Neuve, 1348*  
*BELGIQUE*  
louveaux@core.ucl.ac.be

## Abstract

In this talk, we generalize the concept of a split (that leads to split cuts) to any lattice-point-free polyhedron. We show how we can generate cutting planes for an integer program from these objects. Associated to any lattice-point-free polyhedron, we define a “split-dimension” (which is equal to 1 in the case of a split in the usual sense). We then consider the operation of adding to a polyhedron all cutting planes that we can obtain from considering all the lattice-point-free polyhedra with a split-dimension lower or equal to  $d$ . We call the obtained object the “ $d$ -dimensional split closure” of the initial polyhedron. We discuss whether this object is again a polyhedron or not. As an important illustration, we focus on objects of split-dimension equal to 1 or 2. We also discuss the fact that lattice-point-free polyhedra can be used in order to generalize the integral Farkas Lemma to integer systems with equalities and inequalities. We show in general how we can obtain infeasibility certificates for such systems.

*Join work with Kent Andersen and Robert Weismantel.*