



## *colloquia@iasi*



*"La mente è come un paracadute.  
Funziona solo se si apre"  
A. Einstein*

### **A decomposition theory for vertex enumeration of convex polyhedra**

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#### Abstract

In the last years the vertex enumeration problem of polyhedra has seen a revival in the study of metabolic networks, which increased the demand for efficient vertex enumeration algorithms for high-dimensional polyhedra given by equalities and inequalities. The complexity of enumeration of vertices of polytopes (bounded polyhedral) is a famous open problem in discrete and computational geometry.

In this paper we do not solve this problem, but present a type of fixed parameter tractable result. We apply the concept of branch-decomposition to the vertex enumeration problem of polyhedra

$P = \{x : Sx = b; x \geq 0\}$ . For that purpose, we introduce the concept of  $k$ -module and show how it relates to the separators of the linear matroid generated by the columns of  $S$ . This then translates structural properties of the matroidal branch-decomposition to the context of polyhedra. We then use this to present a total polynomial time algorithm for polytopes  $P$  for which the branch-width of the linear matroid generated by  $S$  is bounded by a constant  $k$ .

The paper is joint work with Arne Reimers.