

# Computational Geometry: Zonoids Visualization

Alberto Parravicini

## 1 Project Proposal

The project will focus on the study of zonoids and their properties.

- Interactive *visualization* of **2-Dimensional Zonoids** of arbitrary polygons.
- Study of the relation between *Zonoids* and *k-levels* of lines arrangements.  
Once again, the idea is to offer an interactive visualization to guide the understanding of these relationship; in fact, given a polygon, it is possible to extract information about its zonoids by analyzing the *k-levels* of the *dual line arrangement* of the polygon.
- The aforementioned visualizations will be embedded in a *webpage* that will provide the reader with the necessary background knowledge about zonoids.  
On a side note, using *incremental visualizations* to show how zonoids and *k-levels* are computed will also improve the understandability of the topic (as an example, showing how the dual of a polygon is built or showing how to find the left-most point on a *k-zonoid*).

The literature about zonoids provide a number of efficient algorithms to compute the *depth map* (i.e. the set of zonoids) [1] and to test whether a point is included in a given zonoid [2].

It would be interesting to show the improvements of some of these efficient algorithms with respect to more naive implementations.

## References

- [1] Harish Gopala and Pat Morin. Algorithms for bivariate zonoid depth. *Computational Geometry*, 39(1):2 – 13, 2008.

- [2] Pat Morin. An optimal randomized algorithm for  $d$ -variate zonoid depth. *Computational Geometry*, 39(3):229 – 235, 2008.