

***Convexity , Topology, Combinatorics, and Beyond:
A workshop in honor of Montejano ´s 60 birthday
(October 3-7, 2011, Puerto Vallarta, Jalisco, Mexico)***

Title/Abstract of the Poster by Petra Wiederhold (CINVESTAV-IPN)

On the relative convex hull

The relative convex hull (RCH) is defined as a generalization of the convex hull. We are interested in the case of the RCH of a (so-called inner) polyhedron (or set of points) A with respect to a (so-called outer) polyhedron B , where B contains A . In the plane, the RCH coincides with the minimum perimeter polygon contained in the difference set $B-A$, which is also called minimal length polygon (MLP) within the context of digital image analysis. The RCH/MLP is applied in image analysis, robot path planning and computer vision. In particular, the MLP provides a multi-grid convergent curve length estimator for the square grid digitization. That means, when a Jordan curve (or arc) is digitized on the square grid using increasing digitization resolution, then the sequence of estimations of curve length given as the perimeters of the MLP's of corresponding digital curves converges to the true length of the original curve. This property has been established as important and desirable for measurements based on modern digital image analysis. Nevertheless, techniques of curve or perimeter length estimation commonly recommended in text books on digital image analysis do not satisfy that multi-grid convergence. The Poster pretends to show that the RCH is an interesting mathematical subject which has important applications. The multigrid convergence of the RCH based curve length estimator was proved using the topology of continua. Algorithms to compute efficiently the RCH/MLP are subject of recent publications and of actual research; they use principally heuristics from geometry but also some tools from Computational Geometry. One of the aims of the actual work on the design of good algorithms to compute the RCH in the plane is to develop first ideas for algorithms to determine the RCH of a polyhedron A with respect to a polyhedron B , in the 3D space. Whereas the proof of multigrid convergence can be generalized for the corresponding RCH based surface area estimator, the RCH does not coincide with a minimal area polyhedron, and there is no efficient algorithm known so far.
