Cut Locus & Medial Axis in Euclidean Space & on Surfaces

Franz-Erich Wolter
Currently visiting professor at MIT
Institute of Computer Science, University of Hannover

February 11, 2000, 2pm - 3h30
Lubrano, CIT bldg., 4th floor, Brown University
Joint Engineering/LEMS - Computer Science/Graphics Seminar

Abstract

The first part of the lecture gives an overview and new results on the Cut Locus and Medial Axis in the Euclidean Space. We show that Cut Locus and Medial Axis are natural tools to be used in *Global Shape Interrogation and Representation*. The second part of the lecture explains how these concepts can be generalized to (curved) surfaces.

The *Cut Locus,* C_A, of a closed set, A, in the Euclidean space, E, is defined as the closure of the set containing all points, p, that have at least two shortest (straight line) segments to A. The *Medial Axis* of a solid D in E is a subset of D containing all points being center of a disc of maximal size that fits in the solid D. The *Medial Axis* of a solid D in E is a subset of D containing all points being center of a disc of maximal size that fits in the solid D. The *Medial Axis* with its related maximal disc radius function can be used to *reconstruct* its reference solid D because D is the union all maximal discs that fit in D. Keeping the medial axis of a reference solid D fixed and modifying the associated disc radius function, e.g. by shrinking or expanding the maximal disc radius function for some subsets of the medial axis, yields a natural *design tool* allowing in a simple way global shape modifications like thinning or fattening the shape.

We also show how geodesic medial curves on surfaces can be computed efficiently by using methods from *Riemannian geometry.* These methods can be applied to compute efficiently *Geodesic Voronoi Diagrams* on surfaces and to compute the *Geodesic Medial Axis* for a surface the boundary of which is given by a finite union of *piecewise curvature continuous arcs.*