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Guest Editor's Foreword

This special issue consists of seven selected articles presented at the Ninth Annual Symposium on Computational Geometry held May 19–21, 1993 in San Diego, California, as part of the 1993 Federated Computing Research Conference (FCRC). It also contains one other paper that is closely related to one of the selected papers. All eight papers were subjected to the usual refereeing process of this journal.

The papers vary a lot and indicate the wideness these days of the field of computational geometry. The first article, by Nina Amenta, lays a connection between generalized linear programming and a collection of results from combinatorial geometry called Helly-type theorems. This leads to a nice general paradigm that is used to solve a variety of problems. The second article, by Alok Aggarwal, Baruch Schieber, and Takeshi Tokuyama, gives solutions to a number of geometric optimization problems using a general technique for finding minimum-weight paths in particular weighted graphs. Tamal Dey and Herbert Edelsbrunner, in the third, short article, give new combinatorial bounds for the number of triangle crossings in a set of triangles that share a small number of vertices. From this follows a new bound on the number of halving planes of a set of points in space. The new proof technique is simple and more direct than previous approaches. The fourth article, by Shreesh Jadhav and Asish Mukhopadhyay, studies the computation of a centerpoint in the plane. A centerpoint is a generalization of the notion of median to multidimensional sets. A surprisingly linear-time algorithm is presented, considerably improving the previous known bound of $O(n \log^3 n)$. The next two papers, by Dan Halperin and Micha Sharir, study the complexity of lower envelopes of collections of surface patches. The first of the two papers gives bounds in three-dimensional space. The second paper extends the results to d-dimensional space. (The later paper was not presented at the symposium but was added later to this collection because of the close relation to the other paper.) Such combinatorial bounds are very important because they play a crucial role in the complexity of various algorithms. The next article, by Pankaj Agarwal, Noga Alon, Boris Aronov, and Subhash Suri, studies visibility graphs. Visibility graphs in the plane can have quadratic complexity. Hence, it is important to study compact representations of such graphs. The main contribution of the paper is a rather negative result, showing that representations using clique covers in the worst case give almost no improvement over this quadratic bound. In the final article, Jack Snoeyink and Jorge Stolfi study a long-standing open problem: Can every configuration of convex objects in 3-space be taken apart by translating one subset of the objects away from the remaining objects? The general belief was that this is true, but Snoeyink and Stolfi construct a counterexample with six objects. They extend this into an example of 30 objects for which no part can be moved away using arbitrary rigid motions.

I hope you will enjoy reading this collection of articles. I think it gives a nice snapshot of some of the many challenging directions of research within computational geometry.

MARK OVERMARS
Guest Editor
Utrecht University