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Editorial

Geometric modeling and processing 2006

The fourth international conference on geometric modeling and processing (GMP2006) was held on July 26–28, 2006, in Pittsburgh, USA. The conference provided a forum for researchers and practitioners to present and discuss new approaches to solving geometric problems using a range of computational techniques. This special issue consists of extended versions of selected papers presented at the conference.

Xu and Zhang derive a sixth-order nonlinear geometric flow and uses this flow in solving surface modeling problems such as surface de-noising, surface blending, N-sided hole filling, and free-form surface design with G^2 continuity at the boundary.

Ju et al. describe a method for computing a family of topology and shape-preserving skeletons of a volumetric model. The family of skeletons is parametrized by two user-specified numbers that determine respectively the size of curve and surface features on the skeleton. The resulting structure is particularly suitable for describing cylindrical and plate-like shapes.

Masuda et al. present a discrete framework for incorporating constraints of form features using a hard constraints approach. Using the Lagrange multiplier method, the authors solve a combination of soft and hard constraints, which are useful for deforming 3D models while preserving form features.

Hanniel and Elber present a new idea of converting the overlap test for multivariate normal cones to the problem of intersecting hyper-planes, which is conceptually much simpler than the original problem. Based on the new test, the authors develop an efficient and robust algorithm for solving a system of multivariate equations.

Varady et al. present a robust solution for automatic creation of a CAD-like surface structure over a polygonal mesh. The consistent topology is assured by applying results from combinatorial Morse theory, while the correct geometric location of curve network is the result of tracing methods. The authors demonstrate the efficiency and high quality of the proposed approach by using examples of representative objects reconstructed by Geomagic systems.

Chen et al. develop algorithms for robustly tracking the intersection curves of two continuously deforming piecewise rational surfaces. The mathematical framework is based on singularity theory, which provides a stable way of detecting the transition points of the topological change of the intersection curves. The whole computation is reduced to solving second-order differential geometric equations.

Jain and Zhang present a new approach to robust shape retrieval from databases containing articulated 3D models. Shape retrieval is performed in a spectral domain where each shape is represented by the eigenvectors of an affinity matrix. The authors demonstrate the performance improvement of the proposed approach using test results on the McGill database of articulated 3D shapes.

Yoon et al. propose ensemble as a suitable new technique for normal and surface reconstruction, which can improve the performance of conventional deterministic algorithms by putting them into a statistics-based probabilistic setting. Based on extensive experimental results, the authors show that normal and surface ensembles can successfully be combined to handle noisy point sets.

Schall et al. suggest a new surface reconstruction method which is based on a localization of Kazhdan's global FFT-based approach using adaptive subdivision and partition of unity blending. The authors show that the proposed method preserves the resilience of the global approach, while maintaining higher robustness against noise than conventional techniques.

Dheeravongkit and Shimada propose an inverse-adaptation method for hex-dominant meshes. The method inversely deforms and refines elements at locations where large deformation is expected. Compared with traditional schemes, the proposed method can significantly reduce the problem of geometric interference and the need for adaptive re-meshing.

The guest editors would like to thank all authors and reviewers who contributed to this special issue and to the conference. Our special thanks go to Professor Dave Gossard of MIT who served as the conference chair and also to the past GMP chairs who have established the high standard of the GMP conference series.

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