

References

- [Ayal85] Ayala, D., P. Brunet, R. Juan, and I. Navazo, Object representation by means of nonminimal division quadtrees and octrees, *ACM Trans. on Graphics* 4, 1 (January 1985), pages 41-59.
- [Ball81] Ballard, D. H., Strip trees: A hierarchical representation for curves, *Comm. of the ACM* 24, 5 (May 1981), pages 310-321.
- [Baye72] Bayer, R. and E. M. McCreight, Organization and maintenance of large ordered indices, *Acta Informatica* 1, 3 (1972), pages 1-21.
- [Bent80] Bentley, J. L. and J. B. Saxe, Decomposable searching problems #1: Static to dynamic transformation, *J. of Algorithms* 1 (1980), pages 301-358.
- [Besl85] Besl, P. J. and R. C. Jain, Three-dimensional object recognition, *Computing Surveys* 17, 1 (March 1985).
- [Bezi74] Bezier, P. E., Mathematical and practical possibilities of UNISURF, in *Computer Aided Geometric Design*, Academic Press, New York, NY, 1974, pages 127-152.
- [Blum67] Blum, H., A transformation for extracting new descriptors of shape, in *Models for the perception of speech and visual form*, W. Wathen-Dunn (ed.), MIT Press, Cambridge, Ma., 1967.
- [Bohm84] Bohm, W., Efficient evaluation of splines, *Computing* 33 (1984), pages 171-177.
- [Brow79] Brown, K. Q., *Geometric transformations for fast geometric algorithms*, Ph.D. dissertation, Carnegie-Mellon University, Pittsburgh, Pa., Dec. 1979.
- [Brun87] Brunet, P. and D. Ayala, Extended octree representation of free form surfaces, *Computer-Aided Geometric Design* 4 (1987), pages 141-154.
- [Burt77] Burton, W., Representation of many-sided polygons and polygonal lines for rapid processing, *Comm. of the ACM* 20, 3 (March 1977), pages 166-171.

- [Carl87] Carlbom, I., An algorithm for geometric set operations using cellular subdivision techniques, *IEEE Comp. Graphics App.*, May 1987, pages 44-55.
- [Chaz80] Chazelle, B. and D. P. Dobkin, Detection is easier than computation, in *Proc. 12th Annual ACM Symposium on Theory of Computing*, 1980, pages 146-153.
- [Chaz84] Chazelle, B., Convex partitions of polyhedra: A lower bound and worst-case optimal algorithm, *SIAM J. Comput.* **13**, 3 (1984), pages 488-507.
- [Chaz87] Chazelle, B. and D. P. Dobkin, Intersection of convex objects in two and three dimensions, *J. ACM* **34**, 1 (Jan. 1987), pages 1-27.
- [Clar87] Clarkson, K. L., New applications of random sampling in computational geometry, *Discrete Comput. Geometry* **2** (1987), pages 195-222.
- [Codd70] Codd, E., A relational model of data for large shared data bases, *Comm. of the ACM* **13**, 6 (June 1970), pages 377-387.
- [Come79] Comer, D., The ubiquitous B-tree, *Computing Surveys* **11**, 2 (1979), pages 121-138.
- [Dant63] Dantzig, G. B., *Linear programming and its extensions*, Princeton University Press, Princeton, NJ, 1963.
- [Debo78] Deboor, C., *A practical guide to splines*, Springer-Verlag, Heidelberg, 1978.
- [Dobk76] Dobkin, D. P. and R. J. Lipton, Multidimensional searching problems, *SIAM J. Comput.* **5**, 2 (June 1976), pages 181-186.
- [Dobk80] Dobkin, D. P. and J. I. Munro, Efficient uses of the past, in *Proc. 21st Annual Symposium on Foundations of Computer Science*, Syracuse, NY, 1980, pages 200-206.
- [Dobk83] Dobkin, D. P. and D. G. Kirkpatrick, Fast detection of polyhedral intersection, *Theoret. Comput. Sci.* **27** (1983), pages 241-253.
- [Dyer79] Dyer, C. R. and A. Rosenfeld, Thinning algorithms for grayscale pictures, *IEEE Trans. Pattern Anal. Machine Intell.* **PAMI-1**, 1 (1979), pages 88-89.

- [Edel86a] Edelsbrunner, H., L. J. Guibas, and J. Stolfi, Optimal point location in a monotone subdivision, *SIAM J. Comput.* **15**, 2 (1986), pages 317-340.
- [Edel86b] Edelsbrunner, H., J. O'Rourke, and R. Seidel, Constructing arrangements of lines and hyperplanes with applications, *SIAM J. Comput.* **15**, 2 (1986), pages 341-363.
- [Edel87] Edelsbrunner, H., *Algorithms in combinatorial geometry*, Springer-Verlag, Berlin, 1987.
- [Falo87] Faloutsos, C., T. Sellis, and N. Roussopoulos, Analysis of object oriented spatial access methods, in *Proc. of ACM SIGMOD Conference on Management of Data*, San Francisco, Ca., June 1987.
- [Faux79] Faux, I. D. and M. J. Pratt, *Computational geometry for design and manufacture*, Ellis Horwood, Chichester, Great Britain, 1979.
- [Fink74] Finkel, R. A. and J. L. Bentley, Quad trees - A data structure for retrieval on composite keys, *Acta Informatica* **4** (1974), pages 1-9.
- [Fran82] Franklin, W. R., Efficient polyhedron intersection and union, *Graphics Interface 82*, May 1982, pages 73-80.
- [Fuch80] Fuchs, H., Z. Kedem, and B. Naylor, On visible surface generation by a priori tree structures, *Computer Graphics* **14**, 3 (June 1980).
- [Fuch83] Fuchs, H., G. D. Abram, and E. D. Grant, Near real-time shaded display of rigid objects, *Computer Graphics* **17**, 3 (Summer 1983), pages 65-72.
- [Gonz87] Gonzalez, R. C. and P. Wintz, *Digital image processing*, Addison-Wesley, Reading, Ma., 1987.
- [Gree88] Greene, D., *An implementation and performance analysis of spatial data access methods*, U.C. Berkeley, Master's Report, Feb. 1988.
- [Gunt87a] Gunther, O. and E. Wong, A dual space representation for geometric data, in *Proc. 13th International Conference on Very Large Data Bases*, Brighton, England, Sept. 1987.
- [Gunt87b] Gunther, O. and E. Wong, A dual approach to detect polyhedral intersections in arbitrary dimensions, in *Proc. 25th Annual Allerton Conf. on Comm., Control and Comp.*, Oct. 1987.

- [Gunt87c] Gunther, O., An expert database system for the overland search problem, in *Proc. BTW'87 - Database Systems for Office Automation, Engineering, and Scientific Applications*, Informatik-Fachberichte No. 136, Springer, Berlin, 1987.
- [Gunt88] Gunther, O. and J. Bilmes, *A performance analysis of the cell tree and other spatial access methods*, in preparation, 1988.
- [Gutt84] Guttman, A., R-trees: A dynamic index structure for spatial searching, in *Proc. of ACM SIGMOD Conference on Management of Data*, Boston, Ma., June 1984.
- [Hinr85] Hinrichs, K. H., *The grid file system: Implementation and case studies of applications*, ETH Zürich, Dissertation No. 7734, 1985.
- [Hopc87] Hopcroft, J. E. and D. B. Krafft, The challenge of robotics for computer science, in *Algorithmic and geometric aspects of robotics*, Advances in robotics, Vol. 1, C. Yap and J. Schwartz (eds.), Lawrence Erlbaum Associates, Hillsdale, NJ, 1987.
- [Imai86] Imai, H. and M. Iri, Computational-geometric methods for polygonal approximations of a curve, *Comp. Vision Graph. Image Proc.* **36** (1986), pages 31-41.
- [Kemp87a] Kemper, A. and M. Wallrath, An analysis of geometric modeling in database systems, *Computing Surveys* **19**, 1 (March 1987), pages 47-91.
- [Kemp87b] Kemper, A., P. C. Lockemann, and M. Wallrath, An object-oriented database system for engineering applications, in *Proc. of ACM SIGMOD Conference on Management of Data*, San Francisco, Ca., May 1987.
- [Krie86] Kriegel, H. P. and B. Seeger, Multidimensional order preserving linear hashing with partial expansions, in *Proc. International Conference on Database Theory*, Lecture Notes in Computer Science, Springer, Berlin, 1986.
- [Kung79] Kung, H. T., Systolic arrays, *Computer* **11**, 4 (Dec. 1979), pages 397-409.
- [Kung84] Kung, R., E. Hanson, Y. Ioannidis, T. Sellis, L. Shapiro, and M. Stonebraker, Heuristic search in data base systems, in *Proc. 1st International Conference on Expert Database Systems*, Kiawah, S.C., Oct. 1984.

- [Lee84] Lee, D. T. and F. P. Preparata, Computational geometry - a survey, *IEEE Trans. on Computers C-33*, 12 (Dec. 1984), pages 1072-1101.
- [Mand77] Mandelbrot, B. B., *Fractals: Form, Chance and Dimension*, W. H. Freeman & Co., San Francisco, Ca., 1977.
- [Mant82] Mantyla, M. and R. Sulonen, GWB: A solid modeler with Euler operators, *IEEE Comp. Graphics App.*, Sept. 1982, pages 17-31.
- [Mant83] Mantyla, M. and M. Tamminen, Localized set operations for solid modeling, *Computer Graphics*, July 1983, pages 279-288.
- [Megi84] Megiddo, N., Linear programming in linear time when the dimension is fixed, *J. ACM* **31**, 1 (Jan. 1984), pages 114-127.
- [Meie86] Meier, A., Applying relational database techniques to solid modeling, *Computer-Aided Design* **18**, 6 (July/Aug. 1986).
- [Meie87] Meier, A., *Erweiterung relationaler Datenbanksysteme für technische Anwendungen*, Informatik-Fachberichte No. 135, Springer, Berlin, 1987.
- [Meis88] Meiser, S., Point location in arrangements, in *Proc. of the 4th Workshop on Computational Geometry*, Lecture Notes in Computer Science, Springer, Berlin, 1988.
- [Nava86] Navazo, I., J. Fontdecaba, and P. Brunet, Extended octrees, between CSG trees and boundary representations, in *Proc. of the EUROGRAPHICS'87 Conference*, North-Holland, Amsterdam, April 1986.
- [Nayl86] Naylor, B. F. and W. C. Thibault, *Application of BSP trees to ray-tracing and CSG evaluation*, Georgia Institute of Technology, Technical Report GIT-ICS 86/03, Feb. 1986.
- [Newe80] Newell, M. E. and C. H. Sequin, The inside story on self-intersecting polygons, *LAMBDA*, Second Quarter 1980.
- [Newm79] Newman, W. M. and R. F. Sproull, *Principles of interactive computer graphics*, McGraw-Hill, New York, NY, 1979.
- [Niev82] Nievergelt, J. and F. P. Preparata, Plane-sweep algorithms for intersecting geometric figures, *Comm. of the ACM* **25**, 10 (Oct. 1982), pages 739-747.

- [Niev84] Nievergelt, J., H. Hinterberger, and K. C. Sevcik, The grid file: An adaptable, symmetric multikey file structure, *ACM Trans. on Database Systems* **9**, 1 (March 1984), pages 38-71.
- [Paul87] Paul, H.-B., H.-J. Schek, M. H. Scholl, G. Weikum, and U. Deppisch, Architecture and implementation of the Darmstadt database kernel system (DASDBS), in *Proc. of ACM SIGMOD Conference on Management of Data*, San Francisco, Ca., May 1987.
- [Pav182] Pavlidis, T., *Algorithms for graphics and image processing*, Computer Science Press, Rockville, Md., 1982.
- [Pers77] Persoon, E. and K. S. Fu, Shape discrimination using Fourier descriptors, *IEEE Trans. Syst. Man Cybern.* **7**, 3 (March 1977), pages 170-179.
- [Ponc87] Ponce, J. and O. Faugeras, An object centered hierarchical representation for 3D objects: the prism tree, *Comp. Vision Graph. Image Proc.* **38** (1987), pages 1-28.
- [Prep79] Preparata, F. P. and D. E. Muller, Finding the intersection of a set of N half-spaces in time $O(N \log N)$, *Theoret. Comput. Sci.* **8** (1979), pages 45-55.
- [Prep85] Preparata, F. P. and M. I. Shamos, *Computational geometry*, Springer-Verlag, New York, NY, 1985.
- [Putn86] Putnam, L. K. and P. A. Subrahmanyam, Boolean operations on n -dimensional objects, *IEEE Comp. Graphics App.* **6**, 6 (June 1986).
- [RTI84] RTI, Relational Technology Inc., *INGRES/EQUEL/FORTRAN User's guide, version 3.0, VAX/VMS*, Oct. 1984.
- [Requ80] Requicha, A. A. G., Representations for rigid solids: theory, methods, and systems, *Computing Surveys* **12**, 4 (Dec. 1980).
- [Requ82] Requicha, A. A. G. and H. B. Voelcker, Solid modeling: a historical summary and contemporary assessment, *IEEE Comp. Graphics App.*, March 1982, pages 9-24.
- [Requ83] Requicha, A. A. G. and H. B. Voelcker, Solid modeling: current status and research directions, *IEEE Comp. Graphics App.*, Oct. 1983, pages 25-37.

- [Requ85] Requicha, A. A. G. and H. B. Voelcker, Boolean operations in solid modeling: Boundary evaluation and merging algorithms, in *Proc. IEEE*, Jan. 1985, pages 30-44.
- [Robi81] Robinson, J. T., The k-d-b tree: A search structure for large multidimensional dynamic indexes, in *Proc. of ACM SIGMOD Conference on Management of Data*, April 1981.
- [Rock70] Rockafellar, R. T., *Convex Analysis*, Princeton University Press, Princeton, NJ, 1970.
- [Rous85] Roussopoulos, N. and D. Leifker, Direct spatial search on pictorial databases using packed R-trees, in *Proc. of ACM SIGMOD Conference on Management of Data*, Austin, Tx., June 1985.
- [Sala84] Salari, E. and P. Siy, The ridge-seeking method for obtaining the skeleton of digital images, *IEEE Trans. Syst. Man Cyb.* SMC-14, 3 (1984), pages 524-528.
- [Same84] Samet, H., The quadtree and related hierarchical data structures, *Computing Surveys* 16, 2 (June 1984), pages 187-260.
- [Same85] Samet, H. and R. E. Webber, Storing a collection of polygons using quadtrees, *ACM Trans. on Graphics* 4, 3 (July 1985), pages 182-222.
- [Sche86] Schek, H.-J., Datenbanksysteme für die Verwaltung geometrischer Objekte, in *Proc. of the 16th GI Annual Meeting*, Informatik-Fachberichte No. 126, Springer, Berlin, Oct. 1986.
- [Sell85] Sellis, T., Global query optimization, in *Proc. of ACM SIGMOD Conference on Management of Data*, Austin, Tx., May 1985.
- [Sell87] Sellis, T., N. Roussopoulos, and C. Faloutsos, The R+-tree: A dynamic index for multi-dimensional objects, in *Proc. 13th International Conference on Very Large Data Bases*, Brighton, England, Sept. 1987.
- [Sequ83] Sequin, C. H., M. Segal, and P. Wensley, *UNIGRAFIX 2.0 User's manual and tutorial*, U.C. Berkeley, Technical Report No. UCB/CSD 83/161, Dec. 1983.
- [Sequ85] Sequin, C. H. and P. R. Wensley, Visible feature return at object resolution, *IEEE Comp. Graphics App.* 5, 6 (May 1985).

- [Six86] Six, H.-W. and P. Widmayer, Hintergrundspeicherstrukturen für ausgedehnte Objekte, in *Tagungsband GI - 16. Jahrestagung*, Informatik-Fachberichte No. 126, Springer, Berlin, Oct. 1986.
- [Ston76] Stonebraker, M., E. Wong, P. Kreps, and G. Held, The design and implementation of INGRES, *ACM Trans. on Database Systems* 1, 3 (Sept. 1976), pages 189-222.
- [Ston83] Stonebraker, M., B. Rubenstein, and A. Guttman, Application of abstract data types and abstract indices to CAD data, in *Proc. Engineering Applications Stream of ACM SIGMOD Conference*, San Jose, Ca., May 1983.
- [Ston84] Stonebraker, M., E. Anderson, E. Hanson, and B. Rubenstein, QUEL as a data type, in *Proc. of ACM SIGMOD Conference on Management of Data*, Boston, Ma., June 1984.
- [Ston86a] Stonebraker, M. and L. Rowe, The design of POSTGRES, in *Proc. of ACM SIGMOD Conference on Management of Data*, Washington, DC, June 1986.
- [Ston86b] Stonebraker, M., T. Sellis, and E. Hanson, An analysis of rule indexing implementations in data base systems, in *Proc. of the 1st International Conference on Expert Data Base Systems*, April 1986.
- [Ston86c] Stonebraker, M., Object management in POSTGRES using procedures, in *Proc. 1986 International Workshop on Object-Oriented Database Systems*, Asilomar, Ca., Sept. 1986.
- [Tamm82] Tamminen, M., Efficient spatial access to a database, in *Proc. of ACM SIGMOD Conference on Management of Data*, May 1982.
- [Tilo80] Tilove, R. B., Set membership classification: A unified approach to geometric intersection problems, *IEEE Trans. on Computers* C-29, 10 (Oct. 1980), pages 874-883.
- [Tilo84a] Tilove, R. B., A null object algorithm for constructive solid geometry, *Comm. of the ACM* 27, 7 (July 1984).
- [Tilo84b] Tilove, R. B., A. A. G. Requicha, and M. R. Hopkins, Efficient editing of solid models by exploiting structural and spatial locality, *Computer-Aided Geometric Design* 1 (1984), pages 227-239.

- [Whit57] Whitney, H., *Geometric integration theory*, Princeton University Press, Princeton, NJ, 1957.
- [Will82] Willard, D. E., Polygon retrieval, *SIAM J. Comput.* **11**, 1 (Feb. 1982), pages 149-165.
- [Wong85] Wong, E., *Extended domain types and specification of user defined operators*, U.C. Berkeley, Memorandum No. UCB/ERL/M85/3, Feb. 1985.
- [Zahn72] Zahn, C. T. and R. Z. Roskies, Fourier descriptors for plane closed curves, *IEEE Trans. on Computers* **C-21**, 3 (1972), pages 269-281.
- [Zani83] Zaniolo, C., The database language GEM, in *Proc. of ACM SIGMOD Conference on Management of Data*, San Jose, Ca., May 1983.
- [Zhan84] Zhang, T. Y. and C. Y. Suen, A fast parallel algorithm for thinning digital patterns, *Comm. of the ACM* **27**, 3 (March 1984), pages 236-239.