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★Shape interrogation for computer aided design and manufacturing. (English. English summary)

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This book gives a detailed description of algorithms and computational methods for shape interrogation, that is, extracting information from geometric models. It is a complete summary of the recent research by the authors and their co-workers at MIT. Emphasis is placed on the robust solution of systems of nonlinear algebraic equations, which is the main tool used to solve the shape interrogation problems discussed in the book. The book can be used in a course for advanced graduate students and also as a reference text for researchers and practitioners in CAD/CAM.

The book starts with standard material. Chapter 1 reviews Bézier, B-spline, and NURBS representations of curves and surfaces. It contains a short section on the numerical condition of polynomials in Bernstein form, an unusual topic in books on geometric design, but one which sets the tone of the approach used by the authors. Chapters 2 and 3 contain standard material on the differential geometry of curves and surfaces, with emphasis on explicit formulas. After this introductory material, Chapter 4 discusses algorithms for the solution of systems of algebraic equations, the main tool used in the book. Emphasis is given to the projected polyhedron algorithm by E. C. Sherbrooke and Patrikalakis [Comput. Aided Geom. Design **10** (1993), no. 5, 379–405; MR 95b:65029] and to its robust version which uses interval arithmetic, the interval projected polyhedron algorithm by the authors [Comput. Aided Geom. Design **10** (1993), no. 5, 407–429; MR 94j:65026]. Interval arithmetic and its implementation are also described in detail. Chapters 5–11 describe in detail how interrogation problems can be posed as systems of algebraic equations and solved with the techniques of Chapter 4. These problems include curve and surface intersections in Chapter 5 (with more detailed material on the differential geometry of intersection curves in Chapter 6), finding local extrema of distance and curvature in Chapters 7–9, finding geodesic curves on surfaces in Chapter 10, and a detailed discussion of offset curves and surfaces in Chapter 11. The book also contains 51 problems that can be used in graduate courses, an unusual feature in books at this level. The reference list is very complete and up-to-date.

In summary, this is a very detailed and complete book on topics that are important in both the theory and the practice of geometric

modeling. It is a welcome addition to the literature. Reading it and experimenting with the techniques it describes should be a rewarding experience. *Luiz Henrique de Figueiredo* (BR-IMPA)