ELSEVIER

Computer-Aided Design 32 (2000) 625–626

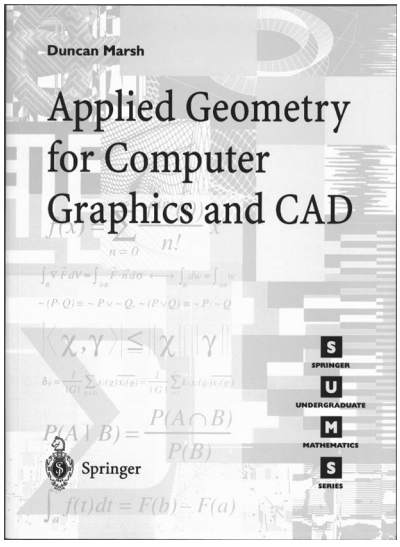
COMPUTER-AIDED DESIGN

www.elsevier.com/locate/cad

Book Review

Painless introduction to geometric concepts and tools in computer graphics and CAD

Applied geometry for computer graphics and CAD; D. Marsh; Springer, London, 1999, 288 pages, ISBN 1-85233-080-5, £18.95



In the preface, the author says that this book explores "the application of geometry to computer graphics and computer-aided design" while covering "the manipulation and the representation of geometric objects". It is a good summary of his aim and, in general, he hits the target.

The author also states he assumes "a knowledge of vectors, matrices and calculus" and that a course based on this text has been taught to engineering and computing students "with only a little knowledge of these topics". I myself use this text during the first 4–6 weeks of courses that I give in computer graphics and geometric modeling. I think it is an excellent text for shepherding engineering students towards an understanding of the basic mathematics needed to get to grips with geometric transformations and basic shape modeling techniques in computer graphics.

Mathematicians can also benefit. Mathematics students often ask where they can find a nice introduction to computer graphics and computer-aided design (CAD); professors have also been known to pose the same question. They will all find an answer here: Marsh's book should guide them effectively and painlessly towards the applications of mathematics and geometry in computer graphics and CAD.

Although I like and use this book, I do not think it is quite suitable as the sole text for a graphics course, because some advanced techniques are not discussed: for example, raster graphics algorithms, photorealistic rendering techniques, computer animation and procedural modeling. Moreover, there is no discussion of solid modeling techniques, and it certainly does not take us as far as the industrial aspects of CAD. But the strength of Marsh's book is in those areas where many conventional textbooks on computer graphics are rather weak, and where books on CAD are often too detailed. Because of its coverage, this text is tailor-made for people who want a concise mathematical approach to these topics.

Let us look briefly at the structure of this book. The first four chapters give just the right amount of material for exploring the mathematical structure behind the viewing transformation of a scene, which is the primary component of the rendering pipeline. The representation of points, lines and planes is naturally introduced in these early chapters, together with homogeneous coordinates, geometric transformations (including translation, rotation, reflection, scaling, shearing and projection) and their concatenation. Compared with conventional textbooks, the presentation here is shorter, with a lot of material introduced rapidly but in a seamless fashion.

The next five chapters discuss the representation of curves and surfaces. The treatment of Bézier and B-spline curves and surfaces is similar to that in other textbooks. Nevertheless, this is a good presentation for students and beginners. In particular, I found the discussions on Non-Uniform Rational B-Spline (NURBS) curves and surfaces very easy to follow. Surprisingly, the presentation of the mathematics of NURBS takes only a few pages, and I think this is a clever and painless introduction to some non-trivial concepts.

I found many of the proofs in this book much easier to understand than those I have seen elsewhere. They look as though they are the result of many years' classroom teaching by an instructor who really cares about students. Examples and exercises are prepared to give students a clear understanding of the material covered, and many of the exercises look quite different from conventional ones, and more interesting. I must admit that I found them very—let us say—"influential" on an exam that I happened to be preparing when this book arrived for review!

On the other hand, I found some of the mathematics a shade less than rigorous: perhaps rigor is occasionally sacrificed to promote ease of understanding? And there are also

PII: S0010-4485(00)00043-9

many places where the wording could be improved and more material added. In particular, the final chapter, on curvature, is rather too terse for engineering students to follow easily; most engineers have no prior exposure to these concepts. Furthermore, as is often the case in the first edition of a textbook, there are a lot of typographical mistakes that need to be corrected. But I hope a second edition will indeed appear; with additional chapters and some more of the author's high-quality examples and exercises.

In summary, I highly recommend the book as a supplementary textbook for senior-level or graduate-level courses in computer graphics or CAD.

M.-S. Kim
Department of Computer Engineering,
Seoul National University,
Seoul 151-742, South Korea
E-mail address: mskim@comp.snu.ac.kr