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projections, 2-D

and 3-D curve

definition

schemes, and

surface

definitions. It also

includes

techniques, such

as B-splines, which

are incorporated

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impressive,  
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in software  
expertise have  
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many others.

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In the third paper  
in this chapter,

Mike Pratt

provides an

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development of

the three most

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techniques:  
cellular  
subdivision,  
constructive solid  
modeling and  
boundary  
representation.  
Although each of  
these techniques  
developed more  
or less  
independently,

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today the  
designer's needs

dictate that a

successful system

allows access to all

of these methods.

For example,

sculptured

surfaces are

generally

represented using

a boundary

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representation.

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However, the  
design of a

complex vehicle

generally dictates

that a sculptured

surface

representation is

most efficient for

the 'skin' while

constructive solid

geometry

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representation is  
most efficient for  
the internal

mechanism. Pratt  
also discusses the  
emerging concept  
of design by  
'feature line'.

Finally, he  
addresses the very  
important  
problem of data

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between solid

modeling systems

and the progress

that is being made

towards

developing an

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Research,

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recent years.  
Because of  
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is now being used  
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is better than ever.  
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require image-  
synthesis  
techniques and  
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Moreover, the techniques of computer animation have become very popular. In this book, we present a wide range of applications of computer graphics. This

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*visu alization.*  
Many papers first

present a

background

introduction to the

topic, followed by

discussion of

current work in the

topic. The volume

is thus equally

suitable for

nonspecialists in a

particular area,

and for the more



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enables general  
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sufficient to apply  
that knowledge in  
the context of  
solving current  
problems. The  
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Virtual Reality  
Techniques, and  
Hardware  
Architectures for  
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the first chapter,  
Val Watson and  
Pamela Walatka  
address the visual  
aspects of fluid**

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**dynamic  
computations.**

***They discuss  
algorithms for  
function-mapped  
surfaces and  
cutting planes,  
isosurfaces,  
particle traces, and  
topology  
extractions. They  
point out that  
current  
visualization***

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**systems are**  
**limited by low**  
**information**

**transfer**

**bandwidth, poor**

**response to**

**viewing and model**

**accuracy**

**modification**

**requests,**

**mismatches**

**between model**

**rendering and**

**human cognitive**

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**capabilities, and  
ineffective**

**interactive tools.**

**However, Watson  
and Walatka**

**indicate that**

**proposed systems  
will correct most of  
these problems.**

**NURBS (Non-  
uniform Rational B-  
Splines) are the  
computer graphics  
industry standard**

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***for curve and surface description. They are now incorporated into all standard computer-aided design and drafting programs (for instance, Autocad). They are also extensively used in all aspects of computer***

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***graphics including  
much of the  
modeling used for  
special effects in  
film and animation,  
consumer  
products, robot  
control, and  
automobile and  
aircraft design. So,  
the topic is  
particularly  
important at this  
time because***

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***NURBS are really at the peak of interest as applied to computer graphics and CAD of all kind.***

***Until recently B-spline curves and surfaces (NURBS) were principally of interest to the computer aided design community, where they have***



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**Free**  
**become the  
standard for curve  
and surface  
description. Today  
we are seeing  
expanded use of  
NURBS in modeling  
objects for the  
visual arts,  
including the film  
and entertainment  
industries, art, and  
sculpture. NURBS  
are now also being**

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**used for modeling  
scenes for virtual  
reality**

**applications. These  
applications are  
expected to  
increase.**

**Consequently, it is  
quite appropriate  
for The.N'URBS  
Book to be part of  
the Monographs in  
Visual  
Communication**

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**Series. B-spline  
curves and**

**surfaces have been  
an enduring  
element**

**throughout my pro  
fessional life. The  
first edition of  
Mathematical  
Elements for  
Computer  
Graphics,  
published in 1972,  
was the first**

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design/interactive

computer graphics

textbook to

contain material on

*B-splines. That*

*material was*

*obtained through*

*the good graces of*

*Bill Gordon and*

*Louie Knapp while*

*they were at*

*Syracuse*

*University. A paper*

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*of mine, presented during the Summer of 1977 at a Society of Naval Architects and Marine Engineers meeting on computer aided ship surface design, was arguably the first to examine the use of B-spline curves for ship design.*

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**For many, B-splines, rational B-splines, and NURBS have been a bit mysterious. Computer Graphics in Engineering Education discusses the use of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) as an**

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**instructional**

**material in**

**engineering**

**education. Each of**

**the nine chapters**

**of this book covers**

**topics and cites**

**examples that are**

**relevant to the**

**relationship of CAD-**

**CAM with**

**engineering**

**education. The**

**first chapter**

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***discusses the use of computer graphics in the U.S. Naval Academy, while Chapter 2 covers key issues in instructional computer graphics. This book then discusses low-cost computer graphics in engineering education. Chapter***



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**4 discusses the uniform beam, and the next chapter covers computer graphics in civil engineering at RPI. The sixth chapter is about computer graphics and computer aided design in mechanical engineering at the University of**

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computer graphics  
is the topic of  
Chapter 7, while  
Chapter 8  
discusses  
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in nuclear  
engineering  
education at  
Queen Mary  
College. The last  
chapter reviews**

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Ohio State  
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book will be of  
great interest to  
both educators and  
students of  
engineering, since  
it provides great  
insight about the***

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algorithms, the text  
describes the  
techniques,

approaches, and  
algorithms at the  
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on practical design  
and implementation,  
highlighting how  
graphics software  
works, and  
explaining how

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current CG can generate and display realistic-looking objects. The mathematics is non-rigorous, with the necessary mathematical background introduced in the Appendixes.

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learning include  
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optimization,  
probability and  
statistics. These  
topics are  
traditionally taught in  
disparate courses,  
making it hard for  
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students, or  
professionals, to  
efficiently learn the  
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methods: linear  
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The State of the Art  
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The NURBS Book

Today one of the  
hardest parts of  
computer aided design  
or analysis is first  
modeling the design,  
then recording and  
verifying it. For  
example, a typical

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vehicle such as a tank,  
automobile, ship or

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aircraft might be

composed of tens of  
thousands of

individual parts. Many

of these parts are

composed of

cylinders, flats, and

simple conic curves

and surfaces such as

are amenable to

modeling using a

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constructive solid geometry (CSG) approach. However, especially with the increasing use of composite materials, many parts are designed using sculptured surfaces. A marriage of these two techniques is now critical to continued development of

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computer aided design  
and analysis. Further,

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the graphical user

interfaces used in

most modeling

systems are at best

barely adequate to the

required task. Critical

work on these

interfaces is required

to continue pushing

back the frontiers.

Similarly, once the

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design is modeled, how are the varied and diverse pieces stored, retrieved, and modified? How are physical interferences prevented or eliminated? Although considerable progress has been made, there are still more questions and frustrations than

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answers. One of the fundamental problems of the 1990s is and will continue to be modeling. The second problem is interpretation. With the ever increasing computational power available, our ability to generate data far exceeds our ability to interpret, understand,

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and utilize that data. Among the most dramatic elements in high-performance computer graphics has been the incorporation of real-time interactive manipulation and display for human figures. The breadth of that effort, as well as the details of its

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and evolved over the

past few years. This

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also presents a solid

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mathematics for the  
field of interactive  
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nearly a decade. This

latest edition is as

relevant as ever,

covering topics from

essential mathematical

foundations to

advanced techniques

used by today's

cutting edge games. --

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President, Valve, May  
2008 Rendering ... has

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been completely  
revised and revamped  
for its updated third  
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on modern techniques  
used to generate three-  
dimensional images in  
a fraction of the time  
old processes took.

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Scores of talented and  
dedicated people serve  
the forensic science  
community,  
performing vitally  
important work.

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However, they are often constrained by lack of adequate resources, sound policies, and national support. It is clear that change and advancements, both systematic and scientific, are needed in a number of forensic science disciplines to ensure

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the reliability of work,  
establish enforceable  
standards, and  
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with consistent  
application.

Strengthening  
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the United States: A  
Path Forward provides  
a detailed plan for  
addressing these needs  
and suggests the



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creation of a new government entity, the National Institute of Forensic Science, to establish and enforce standards within the forensic science community. The benefits of improving and regulating the forensic science disciplines are clear: assisting law

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enforcement officials,  
enhancing homeland  
security, and reducing  
the risk of wrongful  
conviction and  
exoneration.

Strengthening  
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the United States  
gives a full account of  
what is needed to  
advance the forensic  
science disciplines,

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including upgrading of systems and organizational structures, better training, widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. While this book provides an

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developed to  
support video***

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*processor*

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*applications*

*ranging from*

*machine*

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*processing*

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*mmability*

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*units (GPUs)*

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*to present a*

*technique of*

*analysis that*

*aids the*

*formulation,*

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recognize the  
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assumptions, or  
become aware of  
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*equation for a*

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