1 Introduction

The term computer graphics describes any use of computers to create and manipulate images. This book introduces the algorithmic and mathematical tools that can be used to create all kinds of images—realistic visual effects, informative technical illustrations, or beautiful computer animations. Graphics can be two- or three-dimensional; images can be completely synthetic or can be produced by manipulating photographs. This book is about the fundamental algorithms and mathematics, especially those used to produce synthetic images of three-dimensional objects and scenes.

计算机图形一词是指使用计算机创建和处理图像。本书介绍了可用于创建各种图像—真实视觉效果、内容丰富的技术插图或精美的计算机动画--的算法和数学工具。图形可以是二维的，也可以是三维的；图像可以是完全合成的，也可以通过处理照片来制作。本书主要介绍基本算法和数学，尤其是用于制作三维物体和场景合成图像的算法和数学。

Actually doing computer graphics inevitably requires knowing about specific hardware, file formats, and usually a graphics API (see Section 1.3) or two. Computer graphics is a rapidly evolving field, so the specifics of that knowledge are a moving target. Therefore, in this book we do our best to avoid depending on any specific hardware or API. Readers are encouraged to supplement the text with relevant documentation for their software and hardware environment. Fortunately, the culture of computer graphics has enough standard terminology and concepts that the discussion in this book should map nicely to most environments.

在实际操作计算机图形学时，不可避免地需要了解特定的硬件、文件格式，通常还需要了解一两个图形应用程序接口（见第 1.3 节）。计算机图形学是一个快速发展的领域，因此这些知识的具体内容是一个不断变化的目标。因此，在本书中，我们尽力避免依赖任何特定的硬件或 API。我们鼓励读者为自己的软件和硬件环境补充相关文档。幸运的是，计算机图形文化有足够多的标准术语和概念，本书的讨论应该可以很好地映射到大多数环境中。

This chapter defines some basic terminology and provides some historical background, as well as information sources related to computer graphics.

本章定义了一些基本术语，介绍了一些历史背景以及与计算机图形学有关的信息来源。

1.1 Graphics Areas

Imposing categories on any field is dangerous, but most graphics practitioners would agree on the following major areas of computer graphics:

• Modeling deals with the mathematical specification of shape and appearance properties in a way that can be stored on the computer. For example, a coffee mug might be described as a set of ordered 3D points along with some interpolation rule to connect the points and a reflection model that describes how light interacts with the mug.

• Rendering is a term inherited from art and deals with the creation of shaded images from 3D computer models.

• Animation is a technique to create an illusion of motion through sequences of images. Animation uses modeling and rendering but adds the key issue of movement over time, which is not usually dealt with in basic modeling and rendering.

对任何领域进行分类都是危险的，但大多数图形从业人员都会同意计算机图形学的以下主要领域：

- 建模（Modeling）：建模是用数学的方式来规范形状和外观属性，并将其存储在计算机中。例如，一个咖啡杯可以描述为一组有序的三维点，以及连接这些点的插值规则和描述光线如何与咖啡杯相互作用的反射模型。

- 渲染（Rendering）是从艺术中继承下来的一个术语，用于根据三维计算机模型创建阴影图像。

- 动画是一种通过图像序列创造运动幻觉的技术。动画使用建模和渲染，但增加了随时间运动的关键问题，而基本建模和渲染通常不会处理这个问题。

There are many other areas that involve computer graphics, and whether they are core graphics areas is a matter of opinion. These will all be at least touched on in the text. Such related areas include the following:

涉及计算机图形学的领域还有很多，至于它们是否属于核心图形学领域，则见仁见智。文中至少会涉及到这些领域。这些相关领域包括:

• User interaction deals with the interface between input devices such as mice and tablets, the application, feedback to the user in imagery, and other sensory feedback. Historically, this area is associated with graphics largely because graphics researchers had some of the earliest access to the input/output devices that are now ubiquitous.

用户交互涉及诸如鼠标和平板电脑等输入设备、应用程序、以图像形式向用户提供的反馈以及其他感官反馈之间的接口。从历史上看，这一领域在很大程度上与图形学相关，主要是因为图形学研究人员最早接触到了如今已无处不在的输入 / 输出设备

• Virtual reality attempts to immerse the user into a 3D virtual world. This typically requires at least stereo graphics and response to head motion. For true virtual reality, sound and force feedback should be provided as well. Because this area requires advanced 3D graphics and advanced display technology, it is often closely associated with graphics.

虚拟现实试图让用户沉浸在三维虚拟世界中。这通常至少需要立体图形和对头部运动的响应。对于真正的虚拟现实，还应提供声音和力反馈。由于这一领域需要先进的三维图形和先进的显示技术，因此往往与图形技术密切相关。