



SIGGRAPH 1992

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On Computer Graphics and  
Interactive Techniques*

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# COURSE NOTES

# 14

THE OpenGL GRAPHICS  
INTERFACE

*Organizer*

**Randi J. Rost**  
Kubota Pacific

*Lecturers*

**Mason Woo**  
Silicon Graphics Computer Systems, Inc.

**Kurt Akeley**  
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**Mark Segal**  
Silicon Graphics Computer Systems, Inc.

**Linas Vepstas**  
IBM

# The OpenGL Graphics Interface

**SIGGRAPH '92**

## **Course Abstract**

OpenGL is a procedural interface that supports interactive 3D graphics. OpenGL provides developers access to both simple and advanced rendering techniques. Basic capabilities in OpenGL include support for viewing, lighting, and shading. Advanced features include antialiasing, texture mapping, and control over accumulation buffers, stencil buffers, and auxiliary buffers. OpenGL is designed to be window system neutral in order that implementations might be possible for Microsoft Windows, X, and other windowing environments. This course covers the use of OpenGL, explores the philosophy that should be used by application implementors, highlights differences from previous versions of GL, and describes the multivendor organization that supports the OpenGL effort.

# Course Syllabus

Randi Rost	Introductions and logistics	(15 minutes)
Kurt Akeley	OpenGL Overview	(30 minutes)
Randi Rost	OpenGL/Window System Interaction OpenGL design goals Integrating OpenGL with X Integrating OpenGL with NT/Windows	(60 minutes)
Mason Woo	OpenGL Programming, Viewing, and Transformations Example program Geometry drawing commands Color Rectangle primitive Utility library features Bitmaps Display lists Text Geometric transformations Lighting	(90 minutes)
Mark Segal	Rasterization Points, Lines, Polygons Bitmaps Texturing Fog Depth cueing Antialiasing	(90 minutes)
Kurt Akeley	Buffers and Buffer Operations Front/back/aux /stencil/depth/accumulation Write masks Scissor Clear Depth buffering Alpha blending Stencil operations	(45 minutes)
Linus Vepstas	Porting OpenGL OpenGL licensing OpenGL architecture Types of graphics hardware Structure of OpenGL sample implementation Window system integration tradeoffs Conformance and compliance	(60 minutes)
All	Q & A/Wrapup	(30 minutes)

# Table of Contents

Kurt Akeley	OpenGL Overview	slides 1-14
Randi Rost	OpenGL/Window System Interaction	slides 15-36
Mason Woo	OpenGL Programming, Viewing, and Transformations	slides 37-100
Mark Segal	Rasterization	slides 101-148
Kurt Akeley	Buffers and Buffer Operations	slides 149-170
Linus Vepstas	Porting OpenGL	slides 171-202

# Speaker Biographies

## Randi J. Rost

Randi Rost is chief architect for graphics software at Kubota Pacific Computer, Inc. His responsibilities include participating in emerging graphics standards efforts and supporting technology relationships with other organizations. Prior to joining Kubota, Randi was a principal engineer in Digital Equipment Corporation's Palo Alto-based workstation engineering group. He was one of the chief architects for PEX and served as the PEX document editor for the first four years of the effort. He also participated in the design of OpenGL and led Digital's OpenGL implementation effort.

## Kurt Akeley

Kurt Akeley is vice president and chief engineer in the Advanced Systems Division of Silicon Graphics, Inc., and is one of the company's founders. Kurt is responsible for the architecture of the company's next generation high-end graphics technology. He is also currently responsible for the specification of OpenGL.

Kurt's publications include "High-Performance Polygon Rendering," SIGGRAPH '88 Conference Proceedings, "The Accumulation Buffer: Hardware Support for High-Quality Rendering," SIGGRAPH '90 Conference Proceedings, and "The Silicon Graphics 4D/240GTX Superworkstation," July '89 IEEE CG&A. He received a B.E.E. from the University of Delaware in 1980, and an M.S. in Electrical Engineering from Stanford in 1982.

## Mark Segal

Mark Segal is a Member of the Technical Staff in the Advanced Systems Division of Silicon Graphics. He is the primary author of the OpenGL specification. Prior to joining Silicon Graphics, Segal was a doctoral student at the University of California, Berkeley, where his research was in geometric modeling and computational geometry. He has published several papers in the fields of geometric and solid modeling.

## Linas Vepstas

Linas Vepstas is one of the architects supporting graphics in IBM Personal Workstations in Austin, Texas. He has been working with the GL 3D graphics programming interface since 1989, contributing to software, microcode, and hardware design. Dr. Vepstas has a broad range of interests, including advanced rendering techniques, processor design, cluster processing, chaotic dynamics, and genetic systems modeling.

## Mason Woo

Mason Woo is an instructor and course developer in Silicon Graphics customer support (CSD). He has been teaching students about the IRIS Graphics Library since 1985. He co-originated the IRIS Programming Tutorial project and has been a team leader for 5 SGI Tutorium booths at SIGGRAPH. He currently is teaching Motif and GL courses and co-authoring the programming guide for the OpenGL, which will be published by Addison-Wesley later this year.