

3D Compositing and Visual Effects

ITP 360x (3 Units)



Term

Objective

Advanced techniques for 3D animation and visual effects development; including 3D pre-visualization, match moving, dynamics, multi-pass rendering, and digital compositing.

Concepts

Camera and advanced photographic applications for 3D including:

- Camera tracking and match moving, high dynamic range image making, image based lighting, and global illumination.
- Advanced materials, lighting, and rendering techniques.
- Multi-pass rendering and node based compositing.
- Film, video, and chroma-keying for 3D.
- Pre-visualization and pipeline planning techniques.
- 3D asset creation, photorealistic texturing, and asset management.
- Color correction, optical effects, and advanced compositing.
- In addition to a series of weekly assignments, students will apply their knowledge to a final capstone project.

Prerequisites

ITP 215x

Instructor

Lance S. Winkel

Contacting the Instructor

Email Address: winkel@usc.edu
Telephone: 213.740.9956

Office Hours

Office Hours and location. OHE 530 H. Hours TBD

Lab Assistants

TBD

Lecture

1.5 hours per week

Lab

1.5 hours per week

Required Textbooks

Digital Lighting and Rendering (2nd Edition) (Paperback)
Jeremy Birn, (ISBN: 978-0321316318)
Compositing Visual Effects (Paperback)
Steve Wright, (ISBN 978-0-240-80963-2)
Maya Professional Tips and Techniques (Paperback)

Lee Lanier, (ISBN: 978-0470107409)

Online software training resources for software packages being used throughout the class.

Website

Class materials are posted on the USC Blackboard website. <https://blackboard.usc.edu/>

Grading

Intro Project = 10 points

Five Compositing Effects progress checks = 10 points each (50 total)

Six Final Project progress checks = 10 points each (60 total)

Midterm - Finished Composite Project = 40 points

Final project = 60 points

Attendance and Participation = 30 points (-10 points / absence)

Total = 250 points

Grading Scale

A 100-93

A- 92-90

B+ 89-87

B 86-83

B- 82-80

C+ 79-77

C 76-73

C- 72-70

D+ 69-67

D 66-65

F 64 or below

Policies

Projects: All projects and weekly assignments are due at the start of class and are considered late 1/2 hour after class begins. Only one project or assignment may be turned in late. All other late projects will NOT be accepted unless pre-approved by the instructor. With the instructor's approval, on time projects may be redone for additional credit but must be turned in by the following class session. The final project may not be turned in late.

Before logging off a computer, students must ensure that they have emailed or saved projects created during the class or lab session. Any work saved to the computer will be erased after restarting the computer. ITP is not responsible for any work lost.

ITP offers Open Lab use for all students enrolled in ITP classes. These open labs are held beginning the second week of classes through the last week of classes. Please contact your instructor for specific times and days for the current semester.

Incomplete and Missing Grades

Excerpts for this section have been taken from the University Grading Handbook, located at <http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html>. Please see the link for more details on this and any other grading concerns.

A grade of Missing Grade (MG) "should only be assigned in unique or unusual situations... for those cases in which a student does not complete work for the course before the semester ends. All missing grades must be resolved by the instructor through the Correction of Grade Process. One calendar year is allowed to resolve a MG. If an MG is not resolved [within] one

year the grade is changed to [Unofficial Withdrawal] UW and will be calculated into the grade point average a zero grade points.

A grade of Incomplete (IN) “is assigned when work is not completed because of documented illness or other ‘emergency’ **occurring after the twelfth week** of the semester (or 12th week equivalency for any course scheduled for less than 15 weeks).”

Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to your course instructor (or TA) as early in the semester as possible. DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Website and contact information for DSP http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu

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Course Outline

Week 1 – Introduction and Toolsets

- Introduction to the class and course syllabus
- Brief history of compositing and visual effects
- Deconstructing digital images and the rendering process
- Fundamental 3D and digital compositing principles
- Comparing the Combustion and After Effects compositing engines
- Pre-multiplied vs. non-pre-multiplied images

Reading

Reference Slides

Compositing Visual Effects - Chapters 1 and 2

Assignment/Project

Intro Project: Use the provided materials to generate a composite scene with animated layers attributes to enhance overall effect. Export to QuickTime in either the Sorensen 3 or H.264 codec. Due Week 2.

Week 2 – Photographic applications for 3D

- Deconstructing cameras and the photographic process
- Camerawork fundamentals
- Aspect ratios, standards, focus, and exposure principles
- Shooting and image processing for a background plate
- Discuss perspective and depth cues
- Setting up a background plate into a 3D scene

Reading

Reference Slides

Digital Lighting and Rendering - Chapters 1 and 2

Assignment/Project

Composite Effects Scene (Week 1 of 6): Take a photo of an environment to serve as a background plate for a composite scene. Acquire 3D assets to be composited together with the environment. Setup project folder and Maya scene file. Import 2D and 3D assets appropriately. Setup the background plate and then reverse calculate camera settings and position for accurate perspective. Render the vehicle separate from the background plate and composite them together as a QuickTime file. Due Week 3.

Week 3 – Advanced photographic applications for 3D

- Texture gathering
- Limitations of standard low-dynamic range images
- Shooting and Processing High Dynamic Range Images
- Applications for HDRI in 3D

Reading

Reference Slides

Digital Lighting and Rendering - Chapters 3 - 5

Assignment

Composite Effects Scene (Week 2 of 6): Reshoot environments or HDRI assets to support the photorealistic lighting of the scene. Fix any remaining perspective problems. Animate the 3D assets moving realistically in the scene. Re-render based on these changes and use the compositing program to export them as a QuickTime file. Due Week 4.

Week 4 – Compositing 3D with Live Action

- Setup and matching of 3D lighting to a background plate
- Exporting multiple render passes and compositing for shadows
- Image based lighting and reflections
- Realistic materials

Reading

Reference Slides

Digital Lighting & Rendering - Chapters 6 and 7

Assignment

Composite Effects Scene (Week 3 of 6): Apply lighting and materials to scene. Incorporate necessary tools and lighting techniques to achieve desired photorealistic effect. Render the lit and animated scene into separate passes: a 3D objects only pass, a shadow pass for where the 3D objects cast shadows against the environment, and the raw background plate. Composite together into a QuickTime file. Due Week 5.

Week 5 – Multi-pass Rendering

- Using render layers to optimize multi-pass rendering
- Multi layer compositing principles and techniques
- Comparing basic effects and layered composite workflows
- Diffuse, color, shadows, reflections, and occlusion

Reading

Reference Slides

Digital Lighting & Rendering - Chapters 7 and 11

Assignment

Composite Effects Scene (Week 4 of 6): Break down the 3D scene into the following distinct render layers: diffuse, color, background shadows, object shadows, specular highlights, reflections, occlusion, and background plate. Render the layers, and composite together into a QuickTime file. Due Week 6.

Week 6 – Advanced Multi-Pass Rendering

- Specialty layers and channels
- Z-Depth vs. Luminance depth
- Image bit depth, 8-bit vs. 16bit vs. floating point
- Object IDs and the power of custom render passes
- Node based compositing principles and techniques
- Color correction and post effects

Reading

Reference Slides

Compositing Visual Effect - Chapter 3 and 4

Assignment

Composite Effects Scene (Week 5 of 6): Add depth, specific object ID, and specialty render layers to the scene. Render these layers and update the composite to make use of them. Use the depth channel to add depth of field and environment fog effects to the scene. Use additional layers to isolate, color correct, and apply post effects to distinct elements within the scene. Composite together into a QuickTime file. Due Week 7.

Week 7 – Film, Video, Matting, and Chroma Keying

- Deconstructing film, video, and digital video standards
- Aspect ratios, file formats, and frame rates
- Types of mattes and matting techniques
- Chroma Keying
- Making and mattes for 2D elements vs. 3D elements
- Rotoscoping and wire removal

Reading

Reference Slides

Compositing Visual Effect - Chapter 11

Assignment

Composite Effects Scene (Week 6 of 6): Shoot or acquire, and then prepare at least two (2) 2D film or video elements for incorporation into the composite scene. Composite them into the scene along with at least one custom matte element (2D, 3D, rotoscoped, etc.) and when the composite is complete, export into a QuickTime final. Due as midterm Week 8.

Week 8 – Matting Techniques for Particle Systems

- In class review of Composite Effects Scenes (Review Midterms)
- Fundamentals for dynamic motion and animation systems
- Setting up mattes as image sequences
- Applying mattes to particle objects

Reading

Reference Slides

Compositing Visual Effect - Chapters 5 and 6

Assignment

Discuss and hand out instructions for Final Project. Concepts and storyboards due Week 9.

Week 9 – Dynamic Effects

- Intermediate dynamic motion and animation systems
- Rigid body systems
- Simulating complex physical phenomenon
- Managing complexity for efficient feedback

Reading

Reference Slides

Compositing Visual Effect - Chapter 7 and 8

Assignment

Final Project storyboard revisions, asset lists, and production plans due Week 10.

Week 10 – Advanced hard-surface surface construction and texture layout

- Modeling for architecture and from reference
- Modeling for dynamic geometry
- UV layout techniques

Reading

Reference Slides

Compositing Visual Effect - Chapter 9

Assignment

Final Project progress check due Week 11.

Week 11 – Advanced organic surface construction

- Pipelines and production tools for ultra-high polygon modeling
- Normal mapping and detail modeling

Reading

Reference Slides

Assignment

Final Project – Due Final Exam Session. See details below.

Progress Check 1 – Final Project progress check due Week 12.

Week 12 – Advanced material techniques

- Creating complex textures and multi-texture materials
- Advanced rendering and shading nodes
- Procedural textures
- Renderer-specific and proprietary materials

Reading

Reference Slides

Assignment

Final Project progress check due Week 13.

Week 13 – Production planning and management

- Organizing a production pipeline
- Managing assets
- Advanced project folder management and file referencing

Reading

Reference Slides

Assignment

Final Project progress check due Week 14.

Week 14 – Special Topics (1 of 2)

- Special Topic subject to be determined
- Network and distributed rendering for multi-pass rendering

Reading

Reference Slides

Digital Lighting & Rendering - Chapter 12

Assignment

Final Project progress check due Week 15.

Week 15 – Special Topics (2 of 2)

- Special topic subject to be determined
- Guest lecturer to be determined

Reading

Reference Slides

Assignment

Final Project due for turn-in and in-class critique during Final Examination session.

Final Project**Date, Time, and Place**

Due at start of Final Exam session. TBD

ITP 360 – Final Project Details:

Create an effects sequence of no less than 15 seconds and containing three to five consecutive visual effects shots.

Required Components:

The shots must incorporate each of the following:

- 3D assets
- 2D assets (images attached to geometric “cards” or particle “sprites”, animated textures, etc.)
- At least one seamlessly composited film or video asset
- At least one dynamic custom made dynamic visual effect (rigid bodies, particles, nucleus cloth, etc.)

Production Process:

Adhere to a project folder and implement a clean production workflow that includes the following techniques:

- Animation, camera, and lighting techniques necessary to complete each shot effectively
- High Dynamic Range Imagery for photorealistic lighting and reflection mapping
- Multi-pass rendering workflow to support advanced post and compositing
- Node-based or layer-based compositing tools as necessary to assemble the shots and rendered assets.
- Color correction and post tools as necessary to uniformly polish the final project

Assessment:

The Final project is worth 60 points.

Concept art and storyboards are due Week 9.

Storyboard revisions, asset lists, and production plans are due Week 10.

Progress checks are due each week leading up to the Final deadline.

The Final project will be graded based on:

- Demonstrated effort
- Complexity, range, and effective use of tools
- Quality of the finished product (performance, visual quality, etc.)