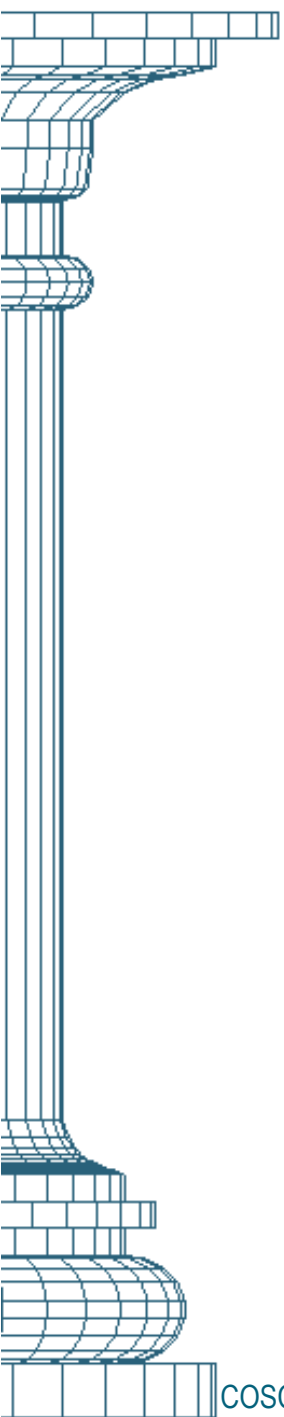# COSC363 Computer Graphics

Course Overview

R. Mukundan (mukundan@canterbury.ac.nz)
Department of Computer Science and Software Engineering
University of Canterbury, New Zealand.

Haere mai

Welcome!

欢迎

R. Mukundan, CSSE, University of Canterbury

People

- Lecturer and Course Supervisor   Office

    Ramakrishnan Mukundan   Erskine 311

    mukundan@canterbury.ac.nz

- Tutors

    Liam Laing   Erskine 320

    liam.laing@canterbury.ac.nz

    Adam Tupper

    atu31@uclive.ac.nz

Timetable 2020

Students must attend one activity from each section.

Lecture A

Activity	Day	Time	Location	Weeks
01	Tuesday	09:00 - 10:00	🎥 C3 Lecture Theatre	17 Feb - 5 Apr 27 Apr - 31 May

Lecture B

Activity	Day	Time	Location	Weeks
01	Wednesday	15:00 - 16:00	🎥 E8 Lecture Theatre	17 Feb - 5 Apr 27 Apr - 31 May

Computer Lab A

Activity	Day	Time	Location	Weeks
01	Friday	14:00 - 16:00	Jack Erskine 131 Lab 1	17 Feb - 5 Apr 27 Apr - 31 May
02	Tuesday	14:00 - 16:00	Jack Erskine 131 Lab 1	17 Feb - 5 Apr 27 Apr - 31 May
03	Friday	09:00 - 11:00	Jack Erskine 131 Lab 1	17 Feb - 5 Apr 27 Apr - 31 May
04	Thursday	16:00 - 18:00	Jack Erskine 131 Lab 1	17 Feb - 5 Apr 27 Apr - 31 May
05	Tuesday	10:00 - 12:00	Jack Erskine 136 Lab 4	17 Feb - 5 Apr 27 Apr - 31 May

Lab sessions commence next week (**25 Feb**)

R. Mukundan, CSSE, University of Canterbury

Course Assessment, Grading

Assessment Item	Worth	Due Date
Assignment -1	20%	**Thu, 2 Apr 2020**
Assignment-2	20%	**Thu, 28 May 2020**
Quizzes	10%	Week 2 - Week 11 (10 quizzes)
Final Exam	50%	TBA

Grading policy: In order to pass this course, you must achieve a minimum of

- 50% of the overall maximum marks including all assessment components. This corresponds to a C− grade.

- 45% of the overall maximum marks in the invigilated assessment item (final exam).

- Marks are sometimes scaled to achieve consistency between courses from year to year.

Quizzes

- Every week (from week-2 to week-11), a new quiz will be added at <u>9am on Monday</u> to the course page on Learn. The quiz will close at <u>5pm on Friday of the following week</u>.

- Each quiz will remain open only for **2 weeks** (Strictly no extensions!)

- There will be a total of 10 quizzes in this course.

- Each quiz is graded based on the first attempt
  - A question within a quiz may be attempted multiple times.
  - A fraction of the marks (25%) will be deducted for each incorrect answer.

- Total contribution to the final grade: 10% (i.e., each quiz carries 1 mark)

> Quiz-1 opens on **24 Feb**
> A sample (ungraded) quiz is now available on Learn.

Course Objectives

The course aims to provide a good understanding of

- Graphics Theory:

    Transformations, Lighting, Projections, Texture mapping, Clipping, Shadow generation etc.

- Graphics Programming

    OpenGL API: v2 and v4 (Traditional and Modern)

    Application development

    Designing models, scenes and animations

    WebGL   New!

- Geometric Algorithms

    Ray tracing

    Surface design

Learning Outcomes

By the end of the course, you should be able to demonstrate knowledge and understanding of fundamental principles in computer graphics, and apply them to
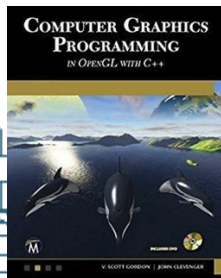
- the design of algorithms for 3D modelling, rendering and animation in various application domains.

- the design and analysis of programs using OpenGL and similar API (WebGL, OpenGL-ES etc).

- the development of GPU based implementations.

- the study of advanced concepts and techniques in the field of Computer Graphics (COSC422).

- the development of skills necessary for large-scale software projects involving 3D graphics models and algorithms.

Tentative Topics, Lecture Plan

	Lectures		Labs
Wk	Tuesday	Friday	Tue, Thu, Fri
1	Introduction	OpenGL Basics	
2	Transformations	Illumination	OpenGL Basics
3	Texture Mapping	Sweep Surfaces	Transformations, Lighting
4	Mathematical Preliminaries	Mathematics of Lighting	Texture Mapping
5	Viewing and Projection	OpenGL 4 Shaders	Sweep Surfaces
6	OpenGL 4 Shaders	OpenGL 4 Shaders	OpenGL 4
7	WebGL	WebGL	Assignment help ●
	Term Break		
8	Ray Tracing	Ray Tracing	OpenGL 4
9	Bezier Surfaces	Tessellation Shader	Ray Tracing
10	Terrain Rendering	Geometry Shader	Ray Tracing
11	Shader Applications	Shader Applications	Terrain Programming
12	Advanced Techniques	Summary	Assignment help ●

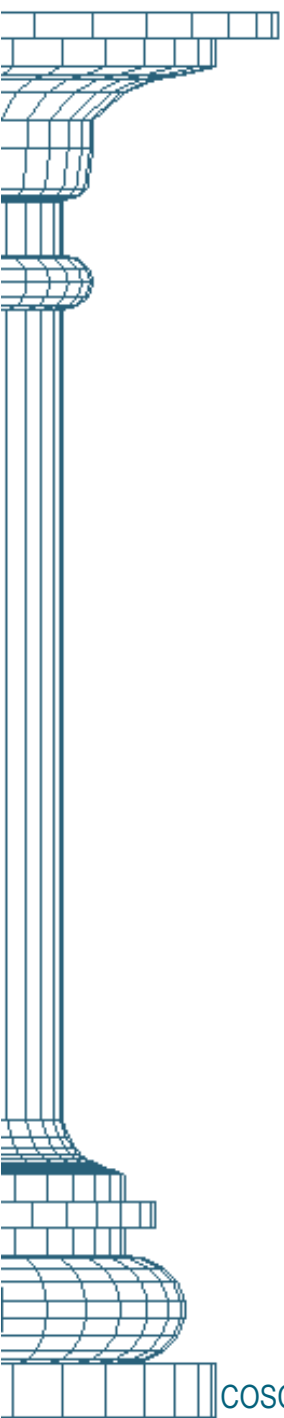R. Mukundan, CSSE, University of Canterbury

Recommended Texts

- V.S. Gordon, ***Computer Graphics Programming in OpenGL with C++***, Mercury Learning and Information, Sep 2018.

- Edward Angel, ***Interactive Computer Graphics***, Addison Wesley, (6e: 2011).

- F.S. Hill, ***Computer Graphics Using OpenGL*** , Prentice Hall 2006.

- Eric Lengyel, ***Mathematics for 3D Game Programming and Computer Graphics***, Cengage Learning, 2011.

- Steven Gortler, ***Foundations of 3D Computer Graphics***, MIT Press, 2012.

- S. Marschner, P. Shirley, ***Fundamentals of Computer Graphics***, A. K. Peters/CRC Press, 4th ed. 2015.

9 ed, 2016

R. Mukundan, CSSE, University of Canterbury

Trivia Quiz!

R. Mukundan, CSSE, University of Canterbury
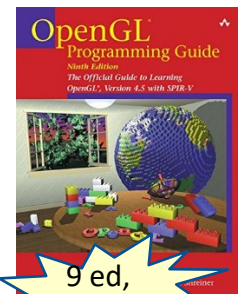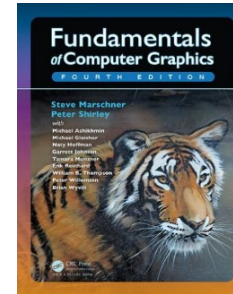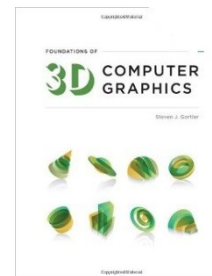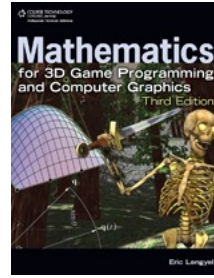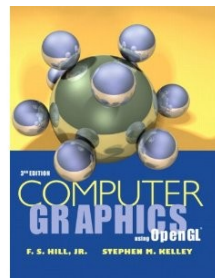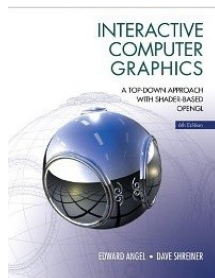
Student's Work: Graphics Factory
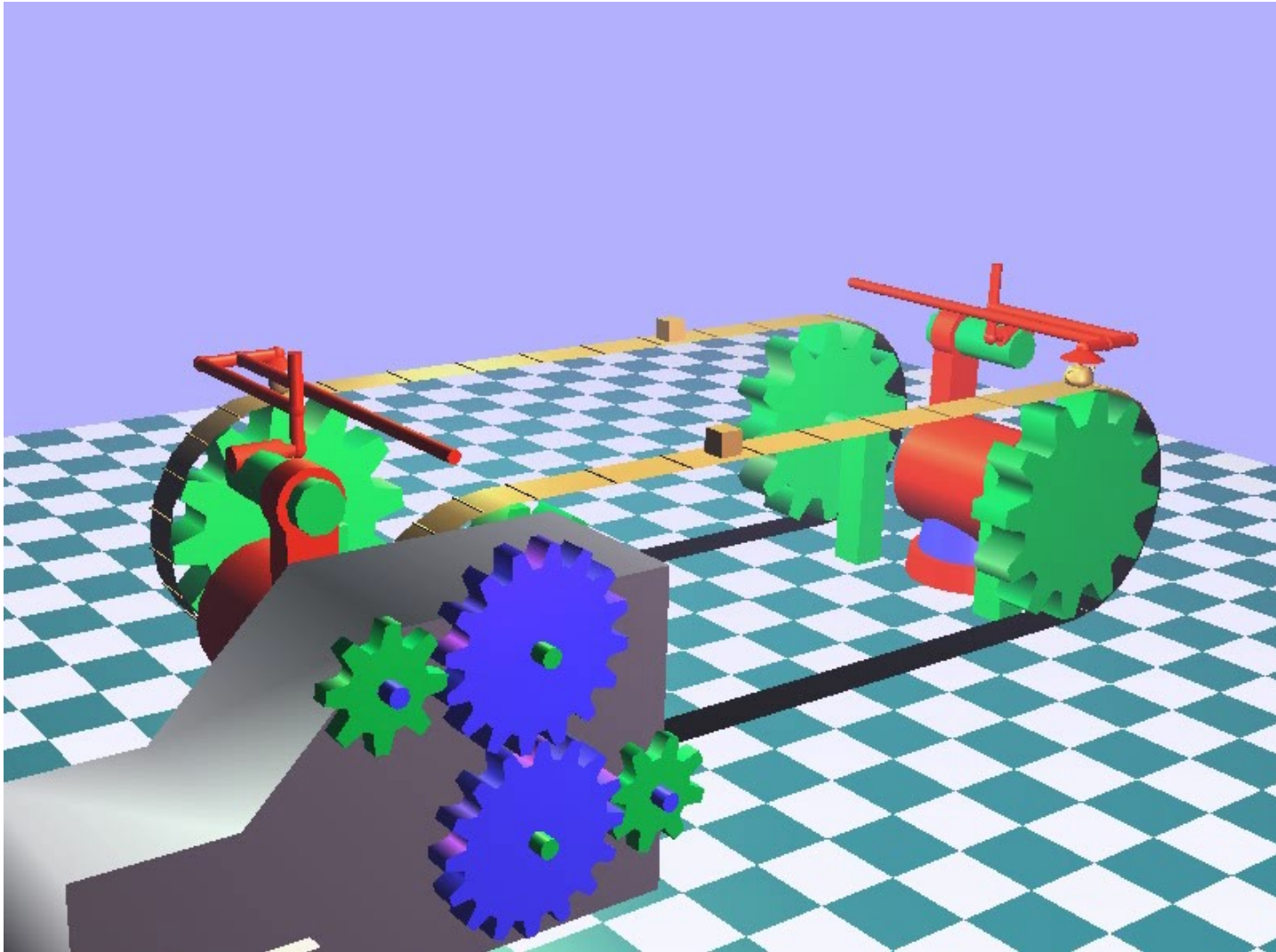
Student's Work: A Theme Park

R. Mukundan, CSSE, University of Canterbury
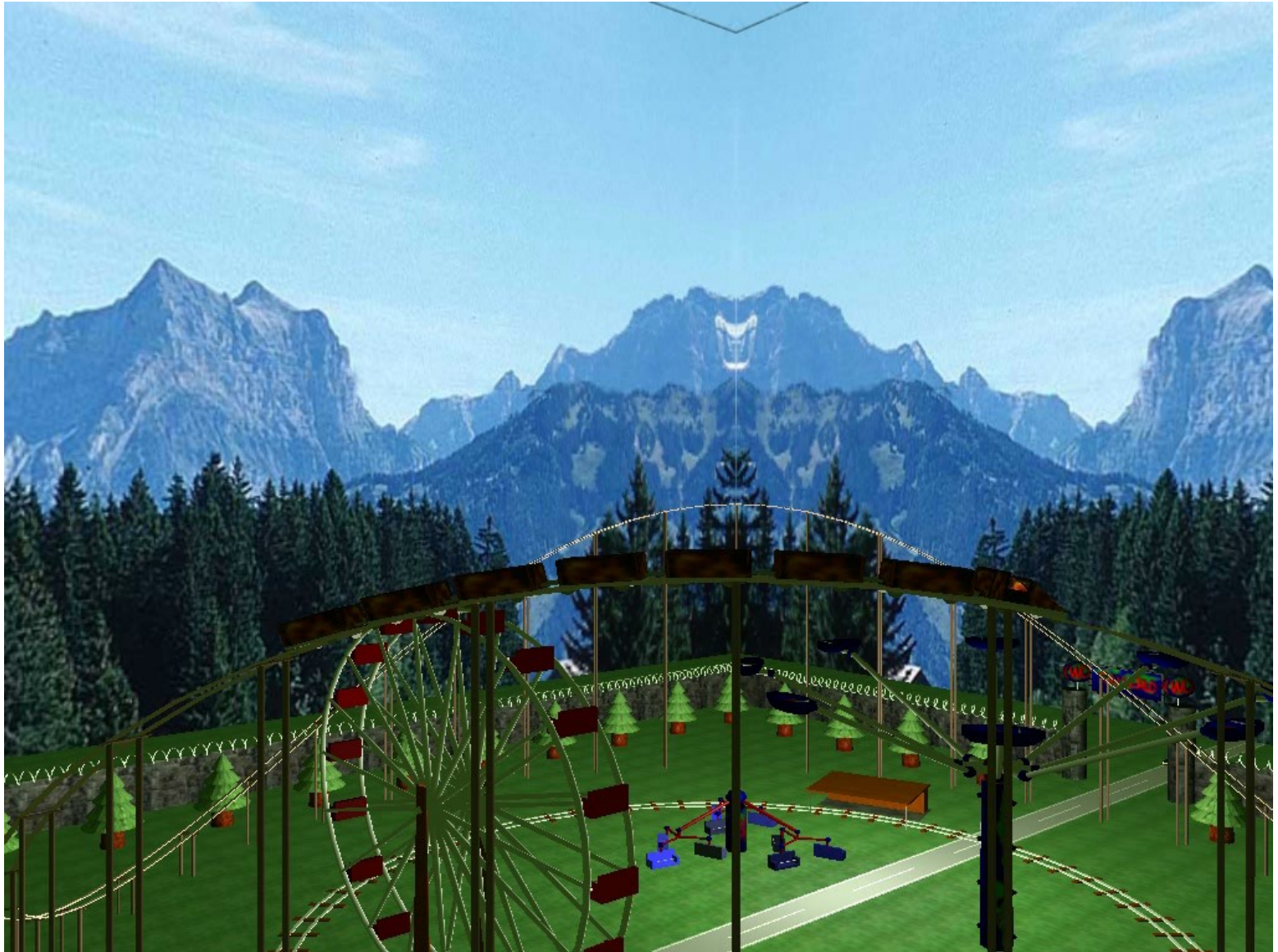
Student's Work: Space Station

R. Mukundan, CSSE, University of Canterbury **15**

R. Mukundan, CSSE, University of Canterbury
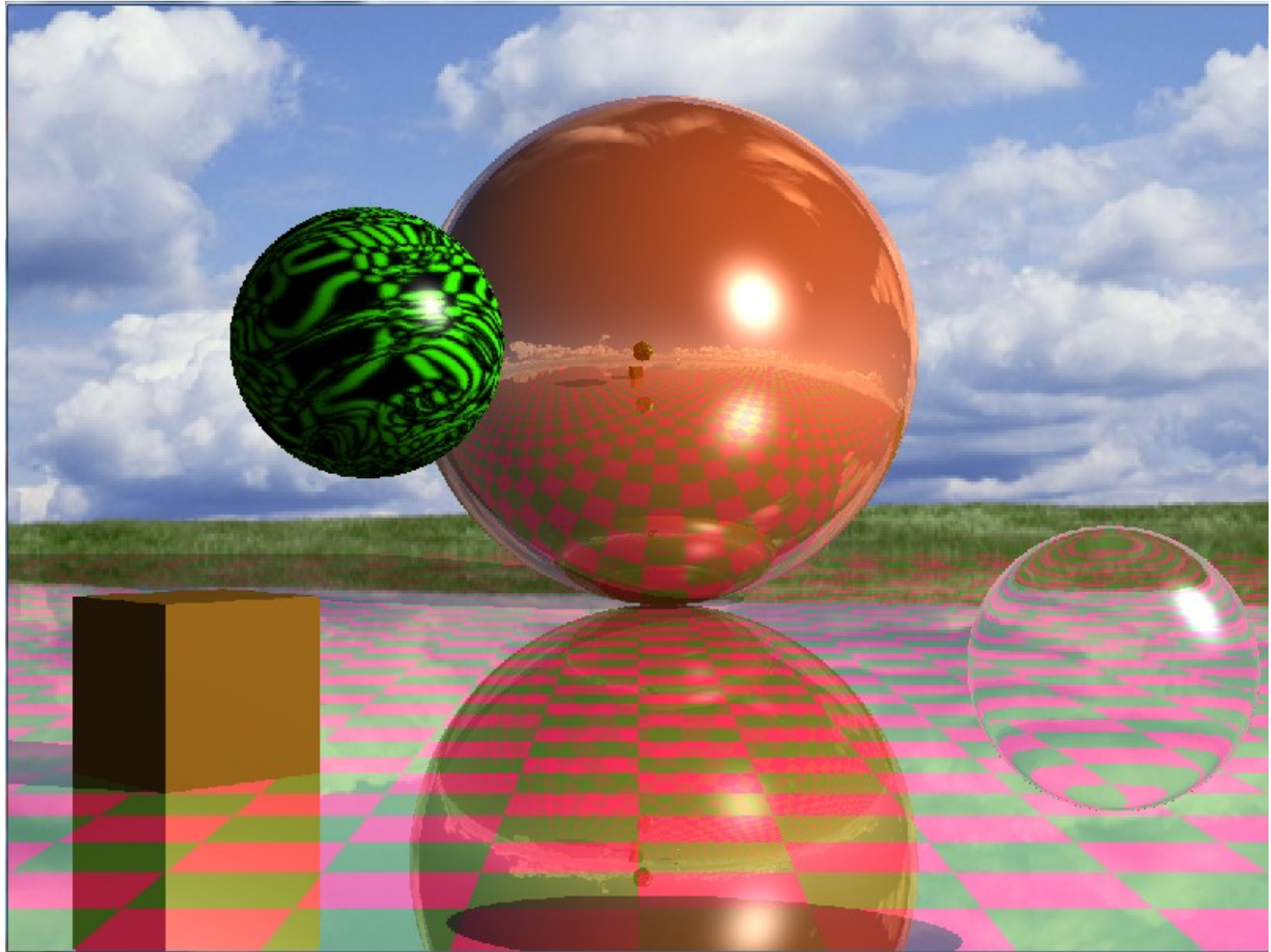
Advanced Application Example
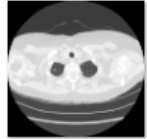# Terrain Models

R. Mukundan, CSSE, University of Canterbury
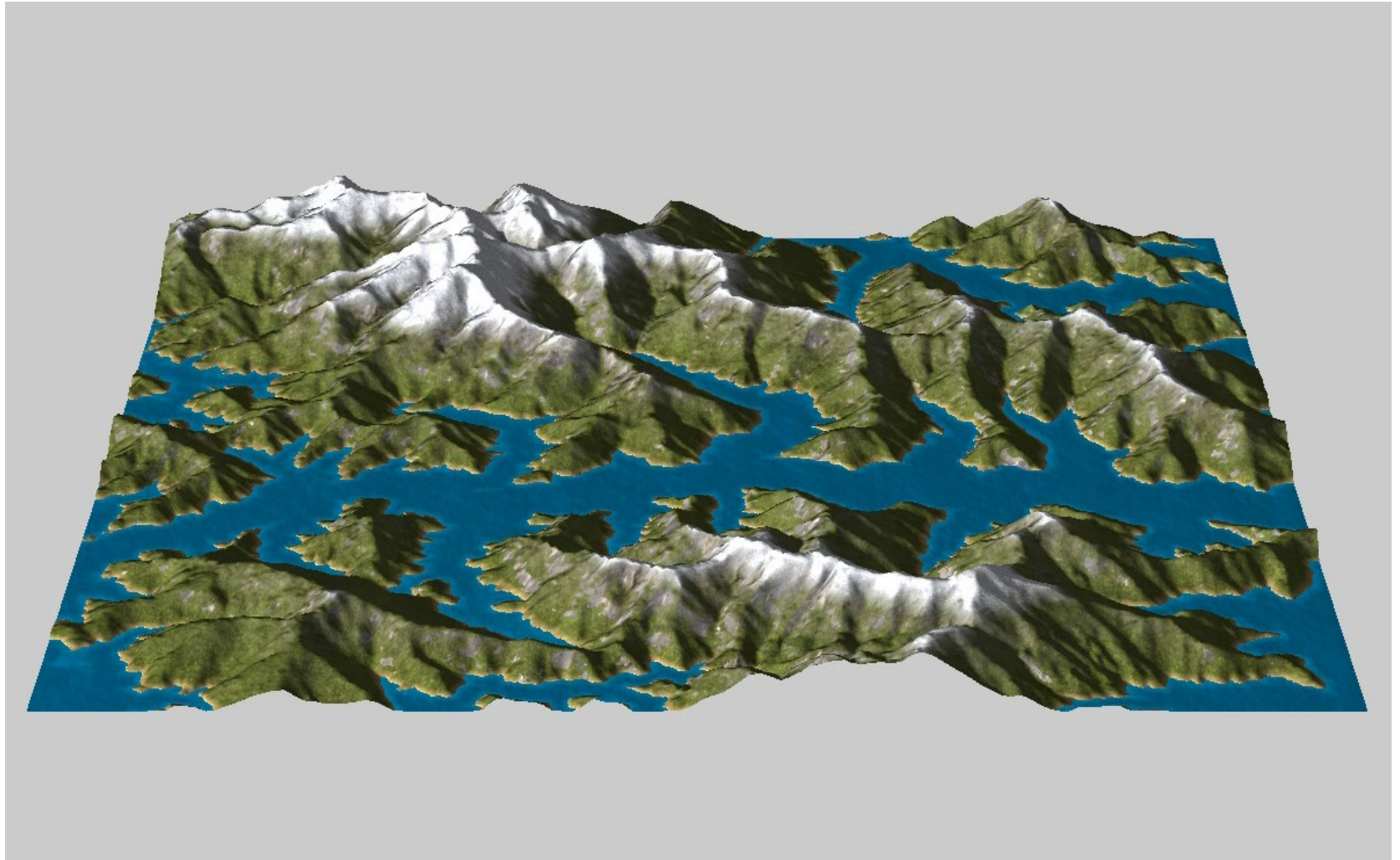
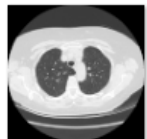# Advanced Application Example
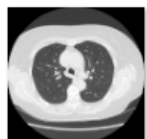# Medical Data Visualization
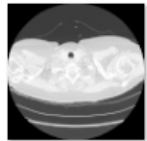
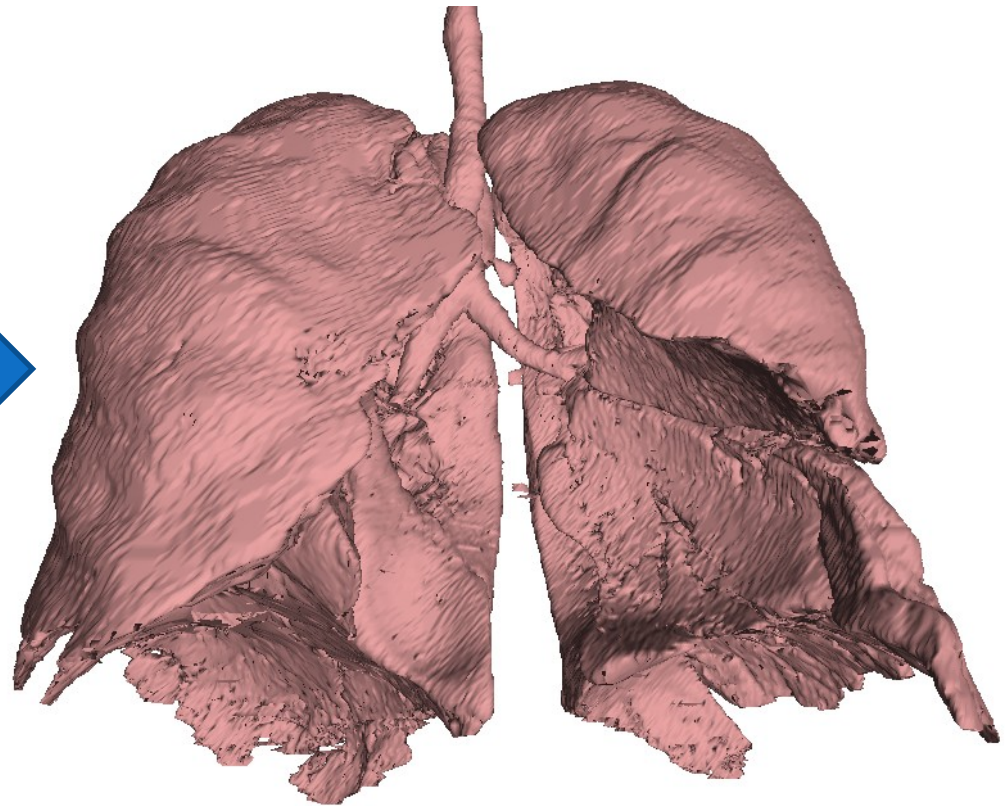
IMS01_011.png

IMS01_022.png
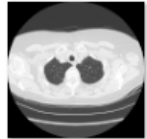
IMS01_033.png

IMS01_044.png

IMS01_055.png

IMS01_066.png

210 Axial
HRCT Scans

Number of triangles ≈ 1.8M

R. Mukundan, CSSE, University of Canterbury