COMP 5115F – Geometry Processing
Fall 2025

Carleton University
School of Computer Science
Course Outline
Last update: August 6, 2025

Course Information

Instructor: Oliver van Kaick
Email: Oliver.vanKaick at carleton.ca
Office location: HP 5348
Best ways to be in touch: in/after class, during office hours, email.
Teaching assistants: a list of teaching assistants and their contact/office hours information will be posted to Brightspace once the course starts.
Classroom: Please check Carleton Central or Brightspace for the room location.
Lecture times: Mondays and Wednesdays, 1:05pm – 2:25pm
Student hours: Information on student hours will be found in Brightspace once the course starts.
Course Website: https://brightspace.carleton.ca/d2l/home/373160

Brightspace access for University of Ottawa Students: please see information at https://gradstudents.carleton.ca/faculty-of-graduate-and-postdoctoral-affairs-access-to-brightspace/

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Calendar.

Course Description

The course covers concepts, representations, and algorithms for analyzing and processing 3D geometric datasets. We will discuss the geometry processing pipeline that starts with the acquisition of geometric models (e.g., with laser scanning or stereo imaging) and goes all the way to the fabrication (3D printing) of the models. More specifically, we will discuss the tasks of acquisition, reconstruction, analysis, manipulation, editing, and fabrication of complex 3D models, and representations such as triangle meshes and implicit functions. The techniques covered have applications in computer graphics, engineering, medical imaging, and many other areas, while the field presents opportunities for research contributions.

Includes: Experiential Learning Activity
Prerequisite(s): None.
Lectures three hours a week.

Learning Material(s) and Other Course/Lab-Related Resources

Recommended book: M. Botsch, L. Kobbelt, M. Pauly, P. Alliez, and B. Levy, "Polygon Mesh Processing", A K Peters/CRC Press, 2010.
We will follow this book closely in the first part of the course. Each topic may also have additional references and suggested readings which are freely available online. The second part of the course will use papers from journals/conferences as references. These papers are also freely available or can be accessed for free through Carleton's library website.

Learning Material	**Options for Purchasing *(e.g., Bookstore, Used, etc.)***	**Approximate Cost**
Book: Polygon Mesh Processing (optional)	Online, e.g., amazon.ca Second-hand book is fine	$140

Topics Covered

- Surface representations and mesh data structures
- Registration and surface reconstruction
- Mesh smoothing and fairing
- Mesh simplification
- Mesh parameterization
- Mesh editing and deformation
- Shape analysis (including learning-based methods)
- 3D printing and fabrication

Learning Outcomes

At the end of this course, students will be able to:

- Summarize the main problems and solution methods in the field of geometry processing.
- Identify the most suitable techniques to address specific problems in geometry processing.
- Implement algorithms for processing of polygonal meshes and apply them to specific datasets.

Assessment Scheme

The grade will be based on the following items:

Component	**Percentage of grade**	**Approximate date**
Assignment 1	10%	End of September
Assignment 2	15%	End of October
Presentation of a paper	15%	Beginning of November
Project	40%	Due the last day of classes

In-person final exam	20%	Centrally scheduled

The project will consist in the implementation and evaluation of a geometry processing technique, followed by a presentation and the submission of a report and the code. The idea is that the paper presentation and assignments will help you to get started with the project: the chosen paper will be ideally on the same topic as the project and will provide you with background about a specific research problem in geometry processing, while the assignments will give you some familiarity with the programming environment for working with 3D geometry. The final exam consists of a review of all the course content. You can bring one sheet of notes, written or printed on both sides, to the final exam.

Late Assignment Policy

Assignment deadlines are strict. The following scheme is applied to late submissions (which includes assignments and the final course project):
- 3 hours late: no penalty
- 3 to 12 hours late: -10%
- 12 to 24 hours late: -20%
- More than one day late: assignment receives a grade of zero.

Assignment submissions are handled electronically (i.e., through Brightspace or Assign2). Technical problems do not exempt you from submitting on time. So, if you wait until the last minute and then have issues with your connection, you will receive a deduction according to the scheme above. Consequently, you are advised to:

- Periodically upload you progress (e.g., upload your progress after each major change; we will only grade your last submission).
- Submit your final work at least one hour in advance of the due date and time.
- Store backups of your assignments in the cloud, e.g., OneDrive, Dropbox, or a private GitHub repository. However, your assignment has to be submitted to Brightspace so that we have a formal, timestamped submission for the assignment. Urls to the cloud will not be accepted as assignment submission.

Some of the assignments consist of programming tasks. You are expected to demonstrate good programming practices such as adding comments and your code may be penalized if it is poorly written. You are also expected to do the necessary preparatory work (i.e., devising an algorithm) before you start coding.

Graduate Academic Advisors

The Graduate Advisors for the School of Computer Science are available in Room 5302 HP; or by email at grad.scs@carleton.ca. The graduate advisors can assist with understanding your academic audit and the remaining courses required to meet graduation requirements.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/tech-support/. Technical support staff may be contacted in-person or virtually, see this page for details: https://carleton.ca/scs/tech-support/contact-it-support/.

Academic Accommodations and Regulations

Academic Accommodation

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Academic Integrity

Students are expected to uphold the values of academic Integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

We will discuss the expectations regarding academic integrity in the first lecture of the course. If you are still unsure about the expectations after that (how to use and cite references or existing code, if collaboration with classmates is permitted), then you must ask your instructor.

Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is always considered academic misconduct. You are never permitted to post, share, or upload course materials without explicit permission from your instructor.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website.

Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Use of tools based on artificial intelligence

All of the assessed activities in this course were designed to be completed by an individual working alone. The use of artificial intelligence tools such as ChatGPT, Copilot, etc., is allowed. However, if you use any of these tools, you have to disclose this in a readme.txt file or report when submitting the activity, just as you would do when reusing code from other sources. Explain what portions of the assignment were created solely by you and what portions were created with the aid of the tool. The use of any of these tools without disclosure will be considered academic misconduct. An exception to this rule is made for automated grammar and punctuation checking tools (such as Grammarly). In addition, do not fully trust these tools and double check any generated code, as AI tools are known to produce incorrect outputs.

Student Concerns

If you have any concerns regarding this course, your first point of contact is me. Please email me or visit during my student hours, and I will do my best to address your concerns. If I cannot resolve the issue, the next point of contact is the School of Computer Science at studentconcerns@scs.carleton.ca. If the concern remains unresolved, the final point of contact is the Office of the Dean of Science at ODScience@carleton.ca. Please follow this order of contact.

Note: You can also bring your concerns to Ombuds services.