

CS 530 Introduction to Scientific Visualization

Fall 2009

Instructor: Prof. Xavier Tricoche

Time: 9:00 am - 10:15 am TR

Class Location: Felix Haas Hall G066

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Teaching Assistant: Nathan Andrysc, LWSN 3151

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Textbooks

- The Visualization Toolkit - An Object-Oriented Approach to 3D Graphic (3rd ed.), Will Schroeder, Ken Martin, Bill Lorensen, ISBN 1-930934-07-6 *[optional]*
- The Visualization Toolkit User's Guide, Kitware Inc., ISBN 1-930934-0804
- Visualization Handbook, C.D. Hansen, C.R. Johnson eds., Elsevier, 2005, ISBN: 0-12-387582-X *[optional]*

Course Philosophy

Scientific Visualization is concerned with the creation of visual representations of numerical datasets obtained through measurements or computations. Research in Scientific Visualization investigates new ways to produce computer generated images that effectively support the analysis and interpretation of large and complex data. The course provides an introduction to the principles and techniques of this discipline. It covers methods corresponding to the visualization of scalar (temperature, density, ...), vector (velocity, electric current, ...), and tensor fields (diffusion, strain, ...), as well as so-called multi-field problems where multiple quantities must be analyzed simultaneously. It combines a description of the algorithms with a presentation of their practical application in science, engineering, and biomedical research. The presentation also includes an informal introduction to Information Visualization. Basic notions of computer graphics and visual perception are introduced at the beginning of the semester for completeness. In addition, implementation assignments revolving around interesting datasets are used to offer a hands-on exposure to the most commonly used visualization techniques.

Prerequisites

CS 334 and 381, or consent of the instructor. CS 251 is recommended.
(do not hesitate to ask if you are interested!)

Tentative schedule

Week	Date	Topic	Task
1	Aug 25 Aug 27	Introduction - Class overview Data Representation and basic processing	
2	Sep 1 Sep 3	Data Representation and basic processing (continued) Computer Graphics Primer	Install VTK and try examples
3	Sep 8 Sep 10	Introduction to VTK Human perception	1st assignment handed out
4	Sep 15 Sep 17	Color visualization	
5	Sep 22 Sep 24	Displays	1st assignment due, 2nd assignment handed out
6	Sep 29 Oct 1	Isosurfaces	
7	Oct 6 Oct 8	Volume rendering Exam 1	2nd assignment due, 3rd assignment handed out
8	Oct 13 Oct 15	Fall Break Transfer functions	
9	Oct 20 Oct 22	Urban visualization	3rd assignment due
10	Oct 27 Oct 29	Streamlines and stream surfaces Texture-based flow visualization	4th assignment handed out
11	Nov 3 Nov 5	Texture-based flow visualization (continued) Exam 2	
12	Nov 10 Nov 12	Topological methods in visualization	4th assignment due
13	Nov 17 Nov 19	Non-photorealistic and illustrative visualization	Final project
14	Nov 24 Nov 26	Non-photorealistic and illustrative visualization (continued) Thanksgiving	Final project
15	Dec 1 Dec 3	Tensor visualization Information visualization	Final project
16	Dec 8 Dec 10	Final project presentations	Final project
17	Dec 15 Dec 17	Qual exam	Final project reports due

Course evaluation

- Assignments (x4): 40%
- Final project: 20% (10% class presentation + 10% report)
- Exams (x2): 15% each
- Attendance: 5% (attendance is required)
- Class participation: 5% at the instructor's discretion

Projects

The projects will involve implementation tasks based on the Visualization Toolkit. VTK is an open source software providing a versatile visualization infrastructure that can be manipulated using scripting languages. [Python](#), [Tcl/Tk](#), and C++ will be the available options for the programming assignments. The VTK installation contains a tutorial and a number of examples that constitute a nice introduction for beginners.

Assignment and Project Reports:

- Self-contained HTML document
- Describe task
- Describe strategy / approach
- Describe and comment results (pictures of working application): use hyperlinking to link to full resolution images in your report.
- Include code along with detailed directions on how to run it

Project grading:

- Completing the tasks in assignment
- Readability and clarity of report
- Thoughtful answers to questions
- “Quality” of visualizations / pictures
- Late assignments: -25% / day unless arranged previously

Exams

Format:

- Closed book
- No calculators, phones, etc...
- One page (US letter) of notes (double sided). These notes must be submitted with the answers.

Material:

- Comprehensive (each test from beginning of course)
- Facts regarding specific topics
- Problem solving
- Communicate (understand question and explain answer)
- Some (but little) maths

Course Policies

refer to [Gene Spafford's web page](#)

Course Resources

- web page: <http://www.cs.purdue.edu/~xmt/classes/CS530>
- mailing list: cs530@cs.purdue.edu

Campus Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Here are ways to get information about changes in this course.

- the instructor will send an email notification to all registered students informing them of a disruption and the corresponding mitigation strategy
- the instructor and TA will remain available through email to answer any questions or concerns.
- the preferred way to share or request information relevant to the entire class will be through the class mailing list