Physics-Based Animation - Coursework

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1 Overview

The aim of this coursework is to design, implement and evaluate a physics-based simulation using C++. The coursework constitutes 70% of the overall assessment for the module. The choice of topics is up to you, as long as it is **relevant**, sufficiently **complex** and **original**.

Here are some guidelines for you to consider:

- Spend some time on a little research before deciding on a physics-based simulation to implement. Try playing with different free online simulations before committing to an approach. Furthermore, read published journals, essays, magazine articles, and book chapters - which are freely available online to help feed your creative and intellectual psyche. You should also make an attempt to summarise and cite your findings in your report.
- Remember, physics-based animation is about assumptions and simplifications - when learning a new concept or algorithm, try and understand the key principles behind them (e.g., in an equation what each variable does). Always try and simplify concepts down to their essence to gain a clear understanding, while considering any limitations and assumptions.
- Physics-based simulations will differ widely. The different effects present unique challenges that you need to identify and overcome while implementing and creating your desired solution. Choose a physics-based simulation which you consider to be within the limitations of your time and resources. The marking scheme is devised to reward taking on a challenge, so a reasonable attempt at a difficult physics-based simulation which includes original and interesting features is likely to attract more marks than a complete implementation of a simple technique.

Your simulation will have to meet the following technical requirements:

- Your simulation must run at 30+ fps.
- Your simulation must be fully buildable and runnable on the Games Lab machines
- Your simulation must include some form of interactivity (*e.g.* moving the camera, changing simulation parameters at runtime, etc)
- Must be stable: No crashes, no memory leaks, no system asserts thrown.

2 Details

The project will be divided into three separate phases assessed independently.

2.1 Pitch

At the start of your project, you will make a brief 5 minute presentation of your project topic and proposed approach. This will allow you to get feedback and some inspiration from the class and lecturer(s) early into the coursework process. In addition, it will ensure that the idea you have is not overreaching what is possible within the time limits of the module.

A mock-up of a screen shot would also be advantageous at this stage. Your presentation should be created in PowerPoint (or equivalent). Your slides must be uploaded to Moodle before the practical session, but you must still take your slides along to the session.

- Deadline: Week 7
- Weight: 10%

Assessment criteria:

This part of the assessment is not graded. You will receive the full 10% if your presentation is deemed satisfactory. To be deemed satisfactory your presentation will have to consist of: The physics-based animation you have decided to create

- The inspiration for your physics-based animation choice
- The goals of your simulation effect
- Core physics-based idea
- Physics-based animation features
- Possible enhancements

2.2 Design

The Physics-Based Design Document will provide a blueprint for your simulation idea and will be used by you to evaluate how well your implementation went. A template of a physics-based design document is provided on Moodle. Please read the template carefully, it describes the information you are expected to provide in the design document. Although you will submit your physics-based design document in Week 11, you are expected to keep it up to date and modify it as your simulation implementation goes on. This will form the basis of your final report.

Deliverables

The physics-based design document submission must be a .pdf file and be in the the SIGGRAPH technical document format. The document specification is available online[1] and a

[1] `http://www.siggraph.org/learn/instructions-authors`

template is provided on Moodle. Please refer to the template for more information about the contents of the design document. Your submission will be made via Moodle.

Deadline: Week 11
Weight: 15%

Assessment criteria:

- Scope, relevance and clarity of the background research
- Appropriateness of the proposed design

2.3 Implementation and Report

Your physics-based implementation is based on your original pitch and supported by the physics-based design document. You must hand in your simulation application in the form of your complete Visual Studio solution folder (furthermore, your implementation will be available on bitbucket with a history of check-ins/updates). All source code must be provided. Also, you must state where you have obtained any other code that is not your own. You can use online or book sources to help you develop some of the functionality, but ensure that state where and what you have used.

The solution folder must be provided and must be submitted in a form which can be run as a Visual Studio solution. If your project requires supplementary software (e.g., external dlls or libs) this must also be provided (unless this is forbidden by the license - in which case a URL for a download must be provided)

Deadline: Week 15
Weight: 45%

Deliverables

1. Report (typically 8 pages long, submitted as a pdf using the ACM SIGGRAPH template)
2. working executable (i.e., able to run on different machines standalone)
3. source code & libraries (i.e., compile and run out the box in Visual Studio)
4. videos & screenshots (i.e., various videos and screenshots of your simulation effect)
5. brief project webpage/wiki (e.g., free online website/blog resource) showing screenshots, youtube links, and an overview explanation of the project
6. Demonstration of your software, delivered on Week 15

The structure of your report will be similar to that of your design report. Please refer to the template for more information. Deviations from the suggested structure are possible. Though your literature review, you will gain familiarity not only with your topic, but with ways of presenting your work. On that basis, you are entitled to make the adjustments to the report structure most appropriate to your project topic.

Assessment criteria:

- Quality of the implementation
- Level of difficulty of the simulation produced
- Creativity and problem solving abilities exhibited in the project.
- Clarity and suitability of the final report

3 Submission and marking scheme summary

The initial presentation will take place on Week 7 during the practical session. The design and final submissions will be made via Moodle. In addition, the software will be demonstrated on Week 15 (time will be announced in due course)

- **Week 07**: Project pitch.
- **Week 11**: Design.
- **Week 15**: Implementation, report and demonstration.

Moodle assignments with submission deadline dates will be set up in due course.

Marking scheme summary

- **Pitch**: 10
- **Design**: 15
- **Implementation and final report**: 45