IT Oral

# Simulation

Airlines, military and NASA.

Everyone dies.

It is thanks to these simulations that lives were saved. The purpose of simulation is to optimise the performance,

* Test
* Train
* Safety
* Investigate how it will run in the real world
* Find limitations

Ultimately, this allows us to improve our physical device by finding the best possible system in the simulation.

Hence we developed the G(A)SP Balloon Simulation. This program models the controlled descent of a steerable stratospheric weather balloon after the balloon has popped and the parachute is deployed. The simulation also includes physics and variable conditions.   
This simulation was based on the balloon planned to be launched by our mechatronics class in September, with the intention of assisting us in testing the limitations and investigating what will be the best possible conditions for the launch.

The model is written in Python 2.7.1, enabling PyGame, and self-constructed physics, GUI and simulation files.

**Simulation** is the [imitation](https://en.wikipedia.org/wiki/Imitation) of the operation of a real-world process or system over [time](https://en.wikipedia.org/wiki/Time).[[1]](https://en.wikipedia.org/wiki/Simulation#cite_note-definition-1) The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors/[functions](https://en.wikipedia.org/wiki/Function_(engineering)) of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time.

Simulation is used in many contexts, such as simulation of [technology](https://en.wikipedia.org/wiki/Technology) for performance optimization, [safety engineering](https://en.wikipedia.org/wiki/Safety_engineering), [testing](https://en.wikipedia.org/wiki/Experiment), [training](https://en.wikipedia.org/wiki/Training), [education](https://en.wikipedia.org/wiki/Education), and [video games](https://en.wikipedia.org/wiki/Video_game). Often, [computer experiments](https://en.wikipedia.org/wiki/Computer_experiment) are used to study simulation models. Simulation is also used with [scientific modelling](https://en.wikipedia.org/wiki/Scientific_modelling) of natural systems or human systems to gain insight into their functioning.[[2]](https://en.wikipedia.org/wiki/Simulation#cite_note-2) Simulation can be used to show the eventual real effects of alternative conditions and courses of action. Simulation is also used when the real system cannot be engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may simply not exist.[[3]](https://en.wikipedia.org/wiki/Simulation#cite_note-3)

Key issues in simulation include acquisition of valid source information about the relevant selection of key characteristics and behaviours, the use of simplifying approximations and assumptions within the simulation, and fidelity and validity of the simulation outcomes. Procedures and protocols for [model verification and validation](https://en.wikipedia.org/wiki/Verification_and_validation_of_computer_simulation_models) are an ongoing field of academic study, refinement, research and development in simulations technology or practice, particularly in the field of[computer simulation](https://en.wikipedia.org/wiki/Computer_simulation).

The simulation.py file contains the core of the simulation itself: the data for the balloon and calculations that determine how the parachute must steer against the imported physics values (and values from calculations done in this file) in order to get to its destination. This is done through the PID algorithm in the function calculatePID(). It then updates the graphics to the GUI.

The G(A)SP Balloon Simulation is a model of a feedback system in the physical world. In the real world, the simulation would generate input from sensors, receive it through serial and send into the user interface, to then calculate the output and send it back to actuators (controlling the steerable parachute) altering the next input. This is the remote collection of data, which is processed and analysed in order to physically alter the next iteration – an automated system.

Finally, you will be required to present what you have learned and developed to your peers through a ten minute, live presentation that must include a demonstration of your application. This will occur in week 18 prior to exams. Even though presentations will occur after the submission due date, a completed version of your presentation slides and application MUST be submitted on the due date.

Your presentation needs to cover the following:

1. An Introduction to the topic you have studied, including a statement of the aspect of the topic you will be demonstrating;
2. An explanation of the underlying computer science principles and algorithms that have allowed the development of the application you have written;
3. A demonstration of the application itself, including an explanation of how the library and/or code you have written implements the concepts presented; and
4. A discussion of the wider applications of the topic beyond what you have demonstrated, from the simple through to the complex and any potential developments currently under research and development or being theorised.

Consider how you can use your demonstration and any graphs, diagrams and examples to clearly and efficiently communicate your message - this will be far more effective than swathes of text on slides.

During the presentation, each member of the group MUST present - this will form the basis of your individual mark during the presentation component of the task.