Problems in Classical Mechanics
Session programme

All talks are 12 minutes long, with 3 minutes reserved for discussion. Please upload your talk onto the computer before your session begins.

Session 1 - Room 1525-626

13:30 **Introduction**

13:35 **The N-body problem: A general formulation with examples in the three body problem**

Simon Purup Eskildsen

13:50 **The Motion of a Glider in 2D**

Peter Granum Nielsen

14:05 **The three body problem: Lagrange points and numerical solutions**

Esben Skovhus Ditlefsen

14:20 **Break**

Session 2 - Room 1525-626

14:30 **Vortex Mechanics - A simple approach**

Esben Rohan Christensen

14:45 **Projectile motion**

Janus Kramer

15:00 **Finding the quickest path: The Brachistochrone Problem**

Simon Panella Pedersen

15:15 **Break**

Session 3 - Room 1525-626

15:25 **Helicopter physics**

Simon V Jensen

15:40 **Tennis racket theorem**

Andreas Springborg

15:55 **Closing**

Talk abstracts

The N-body problem: A general formulation with examples in the three body problem

Simon Purup Eskildsen

This talk is about the N-body problem, and how to find solutions for more than two bodies, using an analytical approach. Firstly a general formulation of the problem is established, whereafter three solutions for special cases are studied and explained, in order to understand how you can solve the problem analytically

The Motion of a Glider in 2D

Peter Granum Nielsen

In my talk I will present the goal of my project and the physics necessary to achieve the goal. This involves giving an introduction to aerodynamics, where I will include various figures. I will also explain the difference between a symmetrical and a cambered airfoil. Regarding to the derivation of the equations for describing the trajectory of the glider, I will not go into much detail. Instead the focus will be on my result, which is the final graph. Finally I will make a conclusion and a short summary. I will also make an outlook.

The three body problem: Lagrange points and numerical solutions

Esben Skovhus Ditlefsen

Since Newton put forth his laws of motion and gravity people have been trying to predict the motions of the heavens. It quickly turned out that this was not as easy as it first seemed, resulting in what is known as the three body problem, the problem of finding orbits that are stable in perpetuity. There are stable configurations, but no general ones. The simplification of such a problem, and one of the specific solutions, the Lagrange points, will be examined. As will some of the numerical tool that can be used to investigate imperfect solutions.

Vortex Mechanics - A simple approach

Esben Rohan Christensen

Vortices appear all around us and have a concrete effect on our everyday lives. This project aims to study the underlying mechanics of vortices in order to understand common natural phenomena like tornadoes and whirlpools. Through an analysis of the mechanics of a simple bathtub vortex, and depending on a negligence of friction or not, two vortices with very different characteristics appear to describe the motion of the fluid particles. It is shown that a consideration of friction in the model is very important in order to understand the dynamics of vortices in nature and that the basic principles of these vortices can be understood with a relatively simple approach.

Projectile motion

Janus Kramer

Projectile motion is a rather complex topic to describe accurately, particularly when considering all the factors that comes into play in calculating the motion of a projectile – gravity, air drag, pressure, winds, humidity, spin etc. This can quickly become long winded and very complex task and it can be necessary to break the topic down and only look at isolated factors. In this presentation I will focus on three idealized situations to describe projectile motion. First I will look at motion and gravity only, then add air drag and finally spin. Even then, we'll still only have an approximation as I assume the projectile is a rigid body and I'm not taking surface properties into account.

Finding the quickest path: The Brachistochrone Problem

Simon Panella Pedersen

I will begin by presenting the general problem and some applications. After that I will explain the general method of solving it, how the problem is approached. In relation to this I will show the actual solution of the problem for a constant gravitational field. After this I will spend some time explaining the method using Fermat's principle and why it is clever. To conclude I will briefly summarize the content of my talk.

Helicopter physics:

Simon V Jensen

Helicopters uplift is created by the rotation of the rotors. This is can simply be explained in two ways, Newton's third law - action -¿ reaction - or fluid dynamics. So the down pressure of the air and the change in pressure of the air. The helicopter has a stabilizing feature. The rotors angular momentum act like a kind of stabilizing and restoring force. Compare the stabilization with a spinning top being hit by another spinning top. The helicopter is controlled by something called a swashplate which also causes the tilt of the helicopter

Tennis racket theorem

Andreas Springborg

In this project I have studied how Euler's equations for rigid body dynamics can be derived, and how they can be used to describe that rigid bodies with a different moment of inertia along the three principal axes rotating around the intermediate one will not maintain their orientation.