

Computational Research Project

Comparison of ordinary differential equation solvers by [Willoughby, Alyece Ellen](#)

The basic objectives are: to compare the 4th order, 5th order, and 6th order of Runge-Kutta or related methods. The research expects you to challenge each method by using various complicated differential equations. The provided programs are written in Fortran..

Bayesian and non-Bayesian statistics by [Mauffray, Richard Griffith](#)

Bayesian statistics is so called statistics based on subjectivity. With prior probability of the related data and the likelihood of a few of data, the posterior probability is derived. You are expected to explore the differences between Bayesian and non-Bayesian statistics with some of typical trails and random data. The Fortran codes will be provided.

Simulation of Newton's equation of motion by [Lee, Ling](#)

The methods are called Verlet and leap-frog methods. These are based on so called symplectic algorithm, which keeps energy conserved. You are expected to investigate the methods with various Newton's equations. The programs are written in C++.

Numerical solutions for nonlinear equations by [Wakeland, Ian P](#)

To solve nonlinear equations, Bairstow, bisection, and Newton's (secant) methods are used in computation. A non-linear equation, such as $3x^5 + x^3 + 2x^2 = 0$, is solved by Bairstow method. The other type of nonlinear equation, such as $x \tan x = 2$, is called transcendental equation, which is solved by bisection or Newton's method. There are quite a few transcendental equations in physics problems. You will investigate the abilities of each method with various nonlinear equations. The programs are written in Fortran.

Interference of electron waves and the AB effect by [Fayard, Amada Linne'](#)

The experiment of Aharonov-Bohm effect is based on a double-slit with electron beam interference though it also includes a shielded solenoid. You will investigate the difference between the double-slit and Aharonov-Bohm experiments. You will also refer to the computational methods. The programs are written in Fortran.