

Survey for Topics of the Computational Research Project

Please enumerate each topic according to your interest, 1 through 5.

- I. Comparison among ordinary differential equation solvers
In general, the number of differential equations to be solved by hand is very limited. Therefore, there are several methods to solve them by computer. This research project will compare how each method can be accurate / effective under various conditions.

- II. Bayesian statistics
Bayesian statistics is a modern paradigm to analyze statistical data. An algorithm of filtering spam emails is one of the famous examples. This research will investigate other applications and properties of Bayesian statistics.

- III. Simulation of Newton's equation of motion
Besides general differential equation solvers, there are some efficient methods to solve a second order differential equation, which is Newton's equation of motion. This will investigate various types of differential equations with the methods under different conditions.

- IV. Numerical solutions for nonlinear equations
A non-linear equation looks like $3x^5 - 5x^4 + x^3 + 2x^2 - 6x = 0$. When it becomes higher degrees, it is not easy to solve; thus, numerical solutions have to be used. Some of physics simulations also employ this type of algorithm. This research will investigate the comparison of several methods and challenges them with different conditions.

- V. Interference of electron waves and the AB effect
With double slits, electron beams can create interference patterns. This is a consequence of the wave property of electrons due to the quantum mechanical aspect. More interestingly, quantum theory contains another layer of property, which is known as gauge invariance. The Aharonov-Bohm (AB) effect suggests an interesting experiment derived by such property. This research will simulate the effect under various conditions.

Put numbers according to your interest of each topic. (1 ⇔ the most interesting through 5 ⇔ the least interesting)

I	II	III	IV	V

Write any comment or reason as for your choice.