Introduction to COMPUTATIONAL PHYSICS

3 credits

Bulletin description:
Introduction to computational methods, with applications to planetary motion, numerical integration, chaotic oscillations, percolation, random walks, diffusion limited aggregation, molecular dynamics simulation, Monte Carlo methods, and Fourier transforms. 2 lectures, 2 one-hour laboratories.
Prereq: PHYS 251, MATH 166 and CSCI 160 or ECE 173. Coreq: PHYS 252.

Instructor: Alexander Wagner
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Meetings: 11:00-12:50 Tu & Th, South Engineering 221
Office Hours: Wednesday 11-12am and by arrangement

Texts: Alexander Wagner
Computational Physics lecture notes
Optional: Harvey Gould, Jan Tobochnik, Wolfgang Christian
An introduction to Computer Simulation Methods
Third Edition, Pearson/ Addison Wesley

Topics:
week 01 Introduction to linux/ programing background/ graphics/ discrete examples
week 02 Continuous motion: solving Newton’s equations, planetary motion, chaos
week 03 Multiple particles, the verlet algorithm
week 04 Continuous systems: the lattice Boltzmann approach
week 05 Diffusion and phase separation
week 06 Solving Electrostatic problems
week 07 Fluid motion: the Navier-Stokes equations
week 08 The rise of turbulence
week 09 Small scale motion and fluctuations
week 10 Simulating rigid body motion
week 11 Immersing particles in a fluid
week 12 Evaporation, wetting, capillary forces
week 13 Phase-separation in fluid systems
week 14 Minimizing energies: the Monte-Carlo approach
week 15 Final project presentations

Schedule: There will be a Midterm and a final as well as regular Student presentations.
Grading: Problems 25%
Midterm 25%
Participation 10%
Projects 40%
A:90% – 100 %; B:80% – 89 %; C:60% – 79 %; D:40% – 59 %; F:0% – 40 %

• Any students with disabilities who need accommodation in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements.

• All work done in this course must be completed in a manner consistent with NDSU University Senate Policy, section 355: Code of Academic Responsibility and Conduct (http://www.ndsu.nodak.edu/policy/355.htm)