

COMPUTATIONAL PHYSICS -- PH322 SPRING TERM 2009

- Instructor:** Dr. Erik Bodegom
Phone/E-Mail: 725-3891 - Bodegom@pdx.edu, We will use blackboard <https://bb.pdx.edu>, but also: <http://physics.pdx.edu/~d4eb/>
Office Hours: Monday 11-12:00 and by appointment, room 128 SB2
Text(s): N. Giordano and H. Nakanishi – “Computational Physics” 2nd edition
 Also see: <http://www.physics.purdue.edu/~hisao/book/> and material handed out as needed
Other books that might be useful (or later when you grow up ☺):
 Numerical Recipes–Press, Teukolsky, etc. Old version: <http://www.nr.com/oldverswitcher.html>
 Similar to Giordano: A first course in computational physics – DeVries
 Similar to Giordano: Computational Physics – Landau and Paez
Grading: Grade = (homework 30%+final (in class) 30%+ project 20%+ class participation 10 % + quizzes 20% + reading comprehension 10%)
Grader: Ryan Kuroda (kuroda@pdx.edu)
Homework: Emailed: format: ESB (*that is YOUR 3 initials*)_(*number of homework assignment*).7z, each exercise should start after input from the grader. **Send your homework to the grader.** Failure will net you a zero. **No late homework accepted.** The worst homework grade will not be counted. Language: Python
Plagiarism: Collaboration is encouraged; copying wholesale from anybody else will result at a minimum in a grade of zero for the assignment. Further sanctions are possible.

Syllabus (subject to revision)

| Week | Week | Tuesday/Thursday - Reading | Assign# | Assignments (due Thursday, by email) | HW Pts out of: |
|------|------|--------------------------------|---------|--|----------------|
| 3/30 | 1 | Ch 1, Appendix A | | Quiz 0: today and Quiz 1: Thursday, Ch 1. | |
| 4/6 | 2 | Ch 2, Appendix D | 1 | 1: 1, 4, 6, Quiz 2: Thursday, Python | 3 |
| 4/13 | 3 | Ap. B, Ch. 3 | 2 | 2: 2, 9, and wlsq, Quiz 3: Thursday | 3 |
| 4/20 | 4 | Ch. 3 and Ap. C | 3 | 2: 14, 18, and two problems below (3_3 and 3_4) | 4 |
| 4/27 | 5 | Ch. 4 | 4 | See two problems below (4_1 and 4_2), and 3: 2, 12. Quiz 4. | 4 |
| 5/4 | 6 | Ch. 5 and 6 | 5 | 3: 22, 34, 37, and 4: 4, 8 | 5 |
| 5/8 | | <i>Friday 5pm Hoffman Hall</i> | | Lecture by Sidney Altman + refreshments | |
| 5/11 | 7 | Ch. 6 and Ap. E | 6 | 4: 10, 17, 19, and 5: 4. Quiz 5. | 4 |
| 5/18 | 8 | Ap. F | 7 | 5: 9, and 6: 1, 9. Presentation of project proposals | 3 |
| 5/25 | 9 | Ch7 | 8 | F: 1, 3 and two problems below: 8_3 and 8_4. Quiz 6. | 4 |
| 6/1 | 10 | Ch. 8 and 9 | 9 | E: 2, 5, 7, and 7: 2, 12 | 5 |
| 6/9 | | Final 6/9: 1015-1205 | | Project due: send to me (zipped: named <i>ESB_project.7z</i> with YOUR 3 initials replacing ESB!) | |

- 3_3: Find the root of $f(x) = \cos(x) - x = 0$ by the method of bisection. How many iterations are necessary to determine the root to eight significant figures?
- 3_4: Repeat 3_3 by using Newton-Raphson and the secant method. Compare the effort to find the roots with 3_3.
- 4_1: Use N-R to solve $x^{2/3} - 169 = 0$.
- 4_2: Find an extremum of $2x^4 - x^3 - x^2 + 17$ between: -10 and 10 . There might be multiple extrema, find at least one.
- 8_3: Evaluate the integral $\int_0^\pi \sin^3 x dx$ using approximations to the integrand that are piecewise linear, quadratic and quartic. With N intervals, and hence $N+1$ points, evaluate the integral for $N= 4, 8, 16, \dots, 1024$, and compare the accuracy of the methods.
- 8_4: Numerically integrate the Fresnel integrals: $C(v) = \int_0^v \cos(\pi w^2 / 2) dw$ and $S(v) = \int_0^v \sin(\pi w^2 / 2) dw$ and evaluate: $I/I_0 = 0.5 \{ |C(v) + 0.5|^2 + |S(v) + 0.5|^2 \}$ and plot the results. This is the pattern of diffraction at a knife-edge.