Computational Physics

(计算物理)

Lecturer:

- Name: Hai-Qing Lin
- Office: 科技楼 C413 (CSRC A310)
- Telephone: 5698-1820
- E-mail: haiqing0@csrc.ac.cn
  (the most effective way)
- Office Hours: Monday 1:30-3:00pm.
  - Students are welcome to visit lecturer's office during other time, although an appointment is usually preferred.
  - Students can also make phone calls and send e-mails.
- Course Secretaries: general office

Teaching Assistant:

Mr. Wenjing Zhu (朱文静)

- Office: 科技楼 C606 , etc.
- E-mail:wjzhu@mail.bnu.edu.cn
- Office Hours: by appointments

Course Schedule:

- **Lectures:**
  - Monday, 15:30 - 16:15, 16:25 - 17:10, (dinner)
    18:00 - 18:45, 18:55 - 19:40

  Tutorial/Lab: Monday, ?

- **Midterm Exam/Project: TBA**

- **Final Exam: TBA**

Course Textbooks & References:

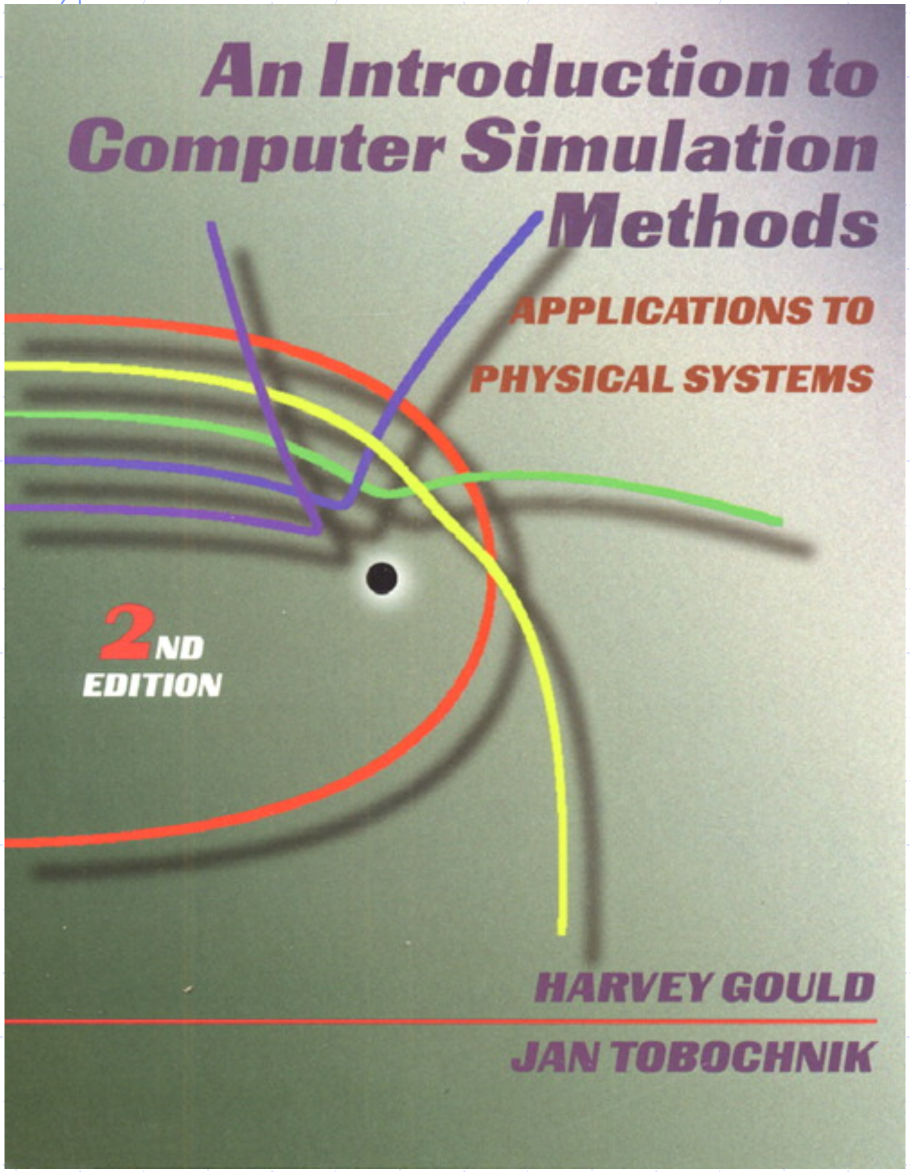
- ***An Introduction to Computer Simulation Methods, Applications to Physical Systems,***
  2nd/ 3rd Edition, Harvey Gould and Jan Tobochnik.
- ***Computational Physics,*** Steven E Koonin, Benjamin Cummins Publishing, 1986.
- ***A First Course in Computational Physics,***
  Paul L. Devries, John Wiley & Sons, 1994
- ***Numerical Receipts in Fortran: The Art of Scientific Computing***, H Press William, 2nd ed. Cambridge Univ. Press
- ***Computational Methods in Physics & Engineering***.

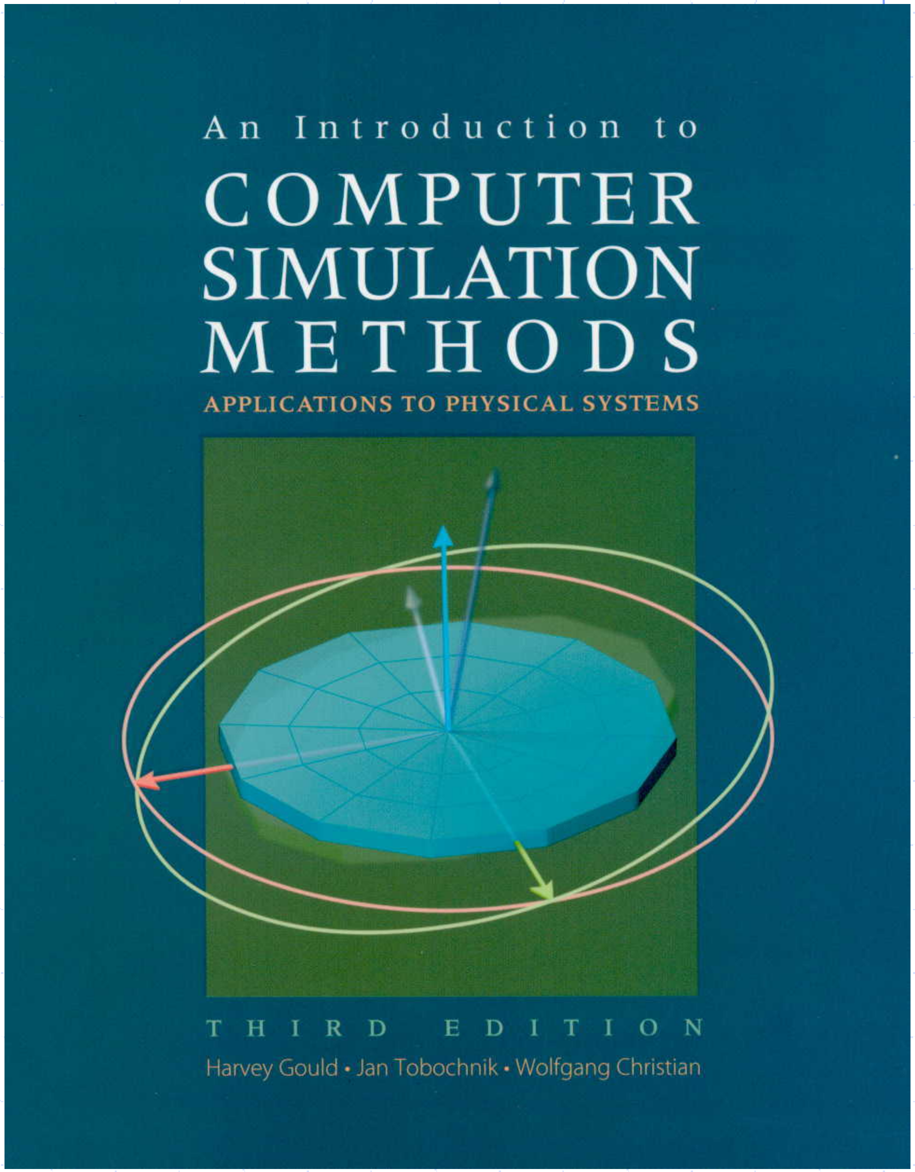
Course Textbooks & References:

- ***Computing for Scientists, Principles of Programming with Fortran 90 and C++,*** R. J. Barlow & A. R. Barner, John Wiley & Sons, 1998.
- ***Monte Carlo methods in statistical physics &***

  The Monte Carlo method in condensed matter physics,. K. Binder, Springer, 1986/1992
- ***Elementary Numerical Analysis***
- ***Solid State Physics***, N.W. Ashcroft & N.D. Mermin
- ***Quantum Theory of Solids***, C. Kittel.
- ***Journal Papers & Monographs* … (as we go on)**

It is essential for students to read books and papers





About the Course:

- **Purpose of the Course:** This course is intended for "graduate students" with solid background in physics, mathematics, and basic knowledge of computer programming.
- Students who did not write computer program before MUST not take this course
- Students who is not familiar with PC or workstations need to work hard
- **Prerequisites:** consult lecturer of the course.
- **Course Language:** English/Chinese.
- **Attendance:** mostly required.

Course Goals:

- To provide a means for you to "simulate", not "compute" physics problems, and to encourage you to "**discover**" physics in a way similar to how physicists learn in the context of research.
- To give you an opportunity to gain a deeper understanding of the physics you have learned in other courses.
- To provide the-state-of-the-art computational methods used for solving physics problems.

Course Goals:

- To learn some commonly and widely used computational techniques in physics research, and have the knowledge of other computational techniques not discussed in details at the class.
- To carry out calculations of some basic quantities (such as the ground state energy, excitation spectrum, heat capacity, magnetization and magnetic susceptibility, single-particle density) describing properties of typical physical systems.

Course Goals:

- To acquire mathematical skills related to integration and data analysis.
- To acquire and appreciate the use of random number in physics research. To be able to write computer program to generate random numbers and perform simulations.
- To acquire the basic principles for further studies on computer simulation of many-body systems.

Course Goals:

- To perform calculations involving diagonalizing Hamiltonian matrix with the Fermi-Dirac or Bose-Einstein statistics, and to relate results to many-body physical problems both non-interacting and interacting particles.
- To perform non-perturbative calculations by using the advanced computational techniques, such as Monte Carlo integration for classical systems, and quantum Monte Carlo simulation for both fermionic and bosonic systems.

Course Goals:

- To make connections to concepts acquired in other physics courses, e.g., thermal physics, quantum physics, mathematical physics, solid state physics, and statistical physics.
- To realize that one should perform detailed calculations in order to gain deep understandings of underline physics for many fascinating observations.

Homework Assignments:

- There will be about **5-7** homework/lab assignments. Typical assignment has 2-3 problems. Homework is required to hand in in time. There will be no excuse for late arrivals except in the case of emergence.
- Performing well in these assignments is essential to get good grade.
- This lecturer believes that students should have health working ethics. Ten to Twelve hours per week is usually required. Any student who does not like to work hard is advised not to take this course.

Grading Policy (subject to change):

- Homework: **20%**
- Projects: **20%**
- Exams/Quizzes: **60%**

- Appeals of grading on homework should be made to TA first within three days, and then to the lecturer if necessary. For project and final exams appeals should be made to the lecturer within a week during office hour or by appointment.

Miscellaneous:

- Add/Drop: Check Graduate Institute Office.
- Add/Drop Deadlines:
  Check Graduate Institute Course Schedule.
- Academic Dishonesty: Copying other's homework or project reports, or cheat during the exams is considered to be the most serious offense, and may result in failure of the course. Being an honest person is far more important than being an 'A' student. The offender bears all the consequences.

Topics and Schedule

- See the Excel file for details
- …