Численные методы в физике полупроводников

Lecturers:
Константин Ладутенко

Language:
Русский

Credit points:
3 з.е.

Monitoring type:
Экзамен

Prerequisites:
Численные методы
Python, начальный уровень

Lectures (a.h)*	Practice (a.h)	Labs (a.h)
16	16	
*1 academic hour = 45 minutes		

Компьютерное моделирование стало жизненно важной частью работы современного физика: оно экономит время и ресурсы, дает исследователям конкурентное преимущество. Существует огромное множество численных методов и подходов к вычислениям в физике, но мы выделим несколько наиболее важных. Мы также уделим внимание часто возникающим трудностям и подводным камням, связанных с этим процессом, сможем проверить полученные знания в решении задач. После выполнения задания у вас будет достаточно опыта, чтобы освоить другие методы, не охваченные стандартными курсами по численному моделированию. Вы сможете также получить больше информации при запуске моделирования с использованием доступного программного обеспечения. Жизненно важно понять основной механизм используемых численных методов. Этот курс поможет вам избежать неправильных результатов моделирования и траты времени на борьбу с ненужными трудностями, которых не возникло бы, если бы был выбран более подходящий численный метод. Например, одной из типичных ошибок является использование метода временной области для исследования модели с высокой добротностью, тогда как в целом предпочтительнее начинать с частотной области или решателя собственных мод. В результате прохождения курса у вас будет знание и опыт, как выбирать лучшие инструменты для ускорения ваших исследований.

Course content

План курса

Структура курса

- (лекция №1) Перед запуском моделирования: таксономия вычислительных задач.

- (лекция №2) Задержка и пропускная способность компьютерной памяти: как адаптировать вашу задачу к современным компьютерным и суперкомпьютерным архитектурам.

- (практика: 14 семинаров) Смотрите прилагаемое задание.

Grading Policy

In the attached assignment file you can find 8 problems split into 4 modules.
1. The initial cost of each problem is one point, so you can earn a maximum of 8 points.
2. To pass a mid-term examination you need to have at least 2 points.
3. The final examination qualifies as:
- 7 points and more - A (excellent)
- 6 - C (good)
- 4 or 5 - E (fair)
- 3 or less - FX (unqualified)
4. Each point is earned personally. To obtain it you need:
- present the code (in Python language) and results
- provide the answer to related questions, most of them are listed in "Self-test" subsections of the assignment. However, any other questions based on the presented code, results, and answers are also possible.
- be able to modify your code and run a simulation if it is needed to prove your answer.
- time slot provided for a single attempt to present the problem can be limited to 3 min. Total number of attempts is only limited by class duration.
5. Problem sequence:
- problems inside the module are passed in sequence.
- module order for each student is given in the table below.
- you can`t present the same problem as the student just before you in the queue.
6. 1/2 multiplier rule:
- A point for any problem presented out of sequence is accounted with 1/2 multiplier.
- Although you can have up to 1 skipped problems in your sequence and present them out of order without 1/2 multiplier.
- An optional problem 4.2 can be skipped without increasing the count of skipped problems.
- Any problem presented after mid-term examinations goes with 1/2 multiplier until you have 2 completed problems.
- During the exams period you can present 2 problems from your sequence without a penalty. Any additional problem above this number goes with 1/2 multiplier.
- An optional FEM problem 4.2 goes without 1/2 multiplier.
- Any problem presented out of scheduled classes goes with 1/2 multiplier. It is possible to schedule an additional class during the last week before the midterm and the exams period.
- For cases which match more than one option in this list, the lowest list element is applied.
7. 2x multiplier rule:
- A first person to present the problem 4.2 will get 2 points.
- Problem 4.2 can be solved in collaboration within the group of up to 3 students. For the first-time presentation each member of this group will be able to get 2 points: 1pt for good knowledge of the related mathematics, 1pt for the code. Special 1 hour class should be arranged for this case.
8. Stamina level
- The initial level of stamina at the beginning of the course is 1 for every student.
- If your stamina is positive then during problem presentation you can choose not to answer any related question. This will decrease your stamina level by one.
- During problem presentation you can ask the teacher a new related question. If the teacher cannot provide a reasonable answer for your question in 3 minutes and the question was good, this will increase your stamina level by one.
- Question novelty means it is not listed in the assignment and was not spoken during the semester by the teacher, assistant, or other students.
- Question goodness is judged by the teacher and can be argued.
- If there is no agreement on the question novelty/goodness, or if the teacher's answer was reasonably good, then the increase of the stamina should be up voted by the majority of persons attending the class, including the teacher and the assistant.
- During the exams period, the stamina level that exceeds or equals 3 can be converted into one additional point accounted during final examination.
- The unfair use of stamina related rules will vanish the stamina level and is judged only by the teacher.