Advanced Computing in Physics and Engineering

APPLAuSE 2015

Format and goals

- **Format of the classes:** recitation + **hands-on sessions**

- What are the aims of this course?

  i) to guarantee a common background in computing/ programming language to all the students,

  ii) to expose the students to some of the most common simulation methodologies in plasma physics (including some of the fundamentals of the algorithms and numerics),

  iii) to use these tools to explore some of the concepts explored in the previous lectures.

Classes

Days of classes

- **Module 1 (MatLab):** 13 ,16, 17, 18, 19 (Nov)
- **Module 2 (PIC):** 23, 24, 25, **26, 27** (Nov)
- **Module 3 (Fluid/MHD):** 2, 3, 4, **7, 9** (Dec)
- **Module 4 (Boltzmann):** 14, 15, 16, **17, 18** (Dec)

Schedule of Classes

See website for updated information

November

Mês/Dia	Hora	Sala
Nov. 13		E5
Nov. 16		I8
Nov. 17		Sala VC IPFN (TNorte)
Nov. 18		QA02.4
Nov. 19	10:00 – 13:00	E1
Nov. 23		C12
Nov. 24		Sala VC IPFN (TNorte)
Nov. 25		QA02.4
Nov. 26		C12
Nov. 27		E5

December

Mês/Dia	Hora	Sala
Dez. 1		Q4.2
Dez. 2		QA02.4
Dez. 3	10:00 – 13:00	E1
Dez. 4		C10
Dez. 7		C12
Dez. 9		QA02.4
Dez. 14	09:00 – 12:00	C12
Dez. 15	09:00 – 12:00	EA1
Dez. 16	15:00 – 18:00	C12
Dez. 17	14:30 – 17:30	E3
Dez. 18	14:30 – 17:30	C12

Homeworks and examination

- **Final Grade:** homeworks (70%) + Final Examination (30%)
- Homework format will vary but it will always imply developing/running codes + interpreting the results
- **Date of Final Examination:** to be determined (most probably in January…)
- **Format of Final Examination:** Hands-on 1/2 hour discussion session

Homework project for MatLab module

Consider the three dimensional dynamics of a charged particle in an arbitrary configuration of externally imposed combination of magnetic and electric fields. The interaction between the particles is neglected.

- Develop a numerical code in MatLab that solves the equations of motion of a set of charged particles, using two different numerical methods to solve for the equations of motion of the charged particles. Compare the two different methods (e.g. Euler vs 4th order Runge Kutta).

- Illustrate the trajectories of a sample set of particles (with randomly initialised temperature) with 2D and 3D plots and with movies.

- Pick up one of the particle drifts that you have studied in the Fundamentals Course and analyse and illustrate the physics of the drift (and the theoretical predictions) with your numerical code.

Due date: Nov 20 @ 8pm

What to hand in: zip file to be downloaded from your DropBox with Matlab code, movies, illustrative plots, etc.

Requirements for the class sessions

- For all classes you should bring your laptop with the following software installed:
    - Matlab (see how to install Matlab with the IST license here <https://delta.ist.utl.pt/software/software.php> - this should be installed from the IST network or using VPN, see below)
    - a telnet/ssh client, in order to connect to remote machines (if you have a Unix/Linux/Mac OS X machine this is trivial, for Windows install the free client PuTTY - google putty to learn more).
- For those that are not familiar with VPN, you should also read how to access the VPN network here: <http://dsi.tecnico.ulisboa.pt/servicos/redes-e-conetividade/vpn/> (in portuguese only, sorry about this)
    - This will allow you to use internet resources as if you were on the IST network (authentication with the IST credentials is required).