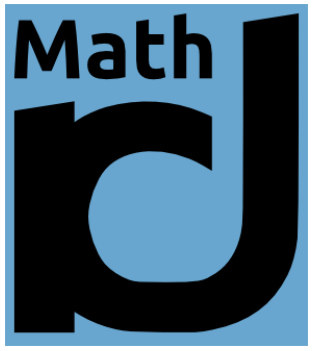
Spring School
High Performance Computing
Numerical Simulation
Polyhedral Compilation

Alain Darte, Violaine Louvet
Anne-Sophie Mouronval, Thierry Dumont



Outline

- Presentation of the school
  - Participants
  - Labex Thematic quarter
  - Origin of the school
- Topics, courses and other aspects
  - Courses, program
  - Organization details

Welcome to all participants !

- 55 participants and 14 speakers / organizers
  - Origin

    France (32+9), Italie (5), Algérie (1), USA (5+2), India (6+1), Canada (1), Allemagne (2), Croatia (1), Switzerland (1+1), Austria (1), Belgique (0+1)
  - Status

    Phd Students (37), Post doc (2), Academic (11), Industry (5)
  - Main groups
    - Polyhedral Code Optimizations and Compilers Communities: 28
    - Applied Mathematics and Applications Communities: 27

Labex MILyon and thematic quarter

- Labex is a national fundin mechanism to structure research at the regional level, through a national loan for investment.
- Labex MILyon to federate computer science and mathematics in Lyon, for research, teaching, industrial transfer, to increase international exchanges, mainly through thematic quarters.
- Thematic quarter on HPC
  - April 6-8 : « HPC Days in Lyon » Conference
  - May 9-13 : Math Info HPC Spring School
  - June 19 : Tutorial on Interval Methods
  - June 27-29 : Joint Laboratory for Extreme-Scale Computing workshop

Check out http://hpc-milyon.universite-lyon.fr

Spring School : Starting Point

- Discussions in the context of **LYONCALCUL**, an initiative to increase interactions between HPC users : Alain Darte, Violaine Louvet, Thierry Dumont, then Tomofumi Yuki, on some **compiler optimizations and tools** (such as Pluto and PPCG) to see if we could be useful to each other or at least make our research interesting for each other.
- In 2013, Alain organized, as part of the Labex MILYON, several events on **compilation for HPC** (see http://labexcompilation.ens-lyon.fr), including a **spring school on polyhedral compilation** with two objectives:
  - to bring the community for the first time together, to present the state-of-the-art, with an opening to some issues,
  - to extend the polyhedral community to newcomers.
- In 2016, Violaine, Thierry, Alain and other people organized, always as part of the Labex MILYON, a **thematic quarter on HPC** with a new spring school, which is also an **"inter-disciplinary thematic school" from CNRS** (french NSF) :
  - this is **not a teaching objective**, but this is a research objective: trying to feed our own research (and the research of PhD students) with a different and missing angle. An application view for compiler people, compiler issues for numerical analysts.
  - **So this is ok that we don't understand everything !** Each community should still learn from its own side (so we need to talk about advanced stuff), but should also learn from the other side (without understanding everything of course).
  - The goal is really to find opportunities of **future interdisciplinary connections**.

Program

- **Monday afternoon:**
  - Introduction to the school and its objectives. Alain, Violaine
  - Presentation of architecture principles, multicores, GPU, use of compilers and code optimizations, from the point of view of a HPC user. Matthieu Haeffele, Maison de la Simulation, Paris Saclay
  - Introduction to numerical schemes and optimization considerations, in particular discontinuous Galerkin schemes. Thierry Dumont, Camille Jordan Institute, Lyon

- **Monday evening:**
  - Introduction to Reproducible Research (experiments, analysis, models). Arnaud Legrand, LIG, Grenoble

- **Tuesday morning:**
  - End of Thierry
  - Numerical Simulation (Tokamak plasma modeling) and implementation on GPUs. Philippe Helluy, IRMA, Strasbourg.

- **Tuesday afternoon:**
  - Introduction to Polyhedral Code Optimizations and Tiling. Alain Darte, LIP, ENS Lyon.
  - Polyhedral Code Transformations via Interactive Visualizations. Oleksandr Zinenko, LRI, Orsay.

- **Tuesday evening:**
  - HPC for Simulations of Transitional and Turbulent Flows. Anne Cadiou, LMFA, Lyon.

- **Wednesday morning:**
  - Introduction to Pluto and its Use in Optimization in Computation Mathematics. Uday Bondhugula, Indian Institute of Sciences, Bangalore.
  - PPCG and Pencil Compiler Design. Sven Verdoolaege, University of Leuven.

Program

- **Wednesday afternoon:**
  - Small walk (or bus if it rains) to Maison Ampère in Poleymieux aux Monts d'Or and visit of the Museum
  - Using the Pluto Compiler/Demo. Uday.
- **Wednesday evening:**
  - Practice with PPCG and Pencil. Sven Verdoolaege and Michael Kruse.
- **Thursday morning:**
  - Roofline Model (Basic and Extended). Markus Püschel, ETH Zürich.
  - Program Generation for Performance (Spiral, LGen). Markus Püschel.
- **Thursday afternoon:**
  - Tiling, Stencils, Tensors. Ramanujam, Louisiana State University.
  - Computational Performance Modeling for Domain Scientists. Raphaël Poncet, CMLA, ENS Cachan.
- **Thursday evening:**
  - Banquet
- **Friday morning:**
  - Numerical Precision. Cindy Rubio-Gonzalez, University of California.
  - End of the school, closing discussions.

Practical Information

- Lunches and dinners, please be on time
- Badges
- Schedule: web site up to date
  - Slides and abstracts later on line
  - Not all speakers will be here the full week
- Don't forget to sign the attendance sheet
- Evaluation survey
- Departure: shuttles, lunch pack
- Visit on wednesday afternoon : walk the visit of the Ampere Museum. Bus if it rains.
- Attendance letters
- Organization chart with photographs