Laboratori del Dipartimento di Matematica

Laboratory of Modeling and Scientific Computing (MOX)

DEPARTMENT

Dipartimento di Matematica

HEAD

Prof. Luca Formaggia

MEMBERS

Staff and post-docs: Luca Formaggia, Piercesare Secchi, Alfio Quarteroni, Davide Ambrosi, Gianni Arioli, Pasquale Ciarletta, Stefano Micheletti, Anna Maria Paganoni, Simona Perotto, Lorenzo Valdettaro, Paola Antonietti, Paolo Barbante, Luca Bonaventura, Carlo De Falco, Edie Miglio, Nicola Parolini, Laura Sangalli, Anna Scotti, Simone Vantini, Marco Verani, Paolo Zunino, Claudia Colciago, Chiara Giverso, Ilario Mazzieri, Mattia Penati, Matteo Pischiutta, Matteo Taffetani, Luigi Vadacca, Chiara Andrà, Domenico Brunetto, Calogero Rizzo, Chiara Montanari, Susanna De Leo, Barbara Martinelli, Luca Paglieri, Giuseppe Aloe, Luca Lo Curto.
PhDCandidates: Francesco Ballarin, Davide Baroli, Mara Sabina Bernardi, Diana Bonomi, Simone Brugiapaglia, Davide Cagnoni, Marzia Angela Cremona, Alberto Ferroni, Bianca Giovanardi, Rocco Michele Lancelotti, Daqing Liu, Alessandra Menafoglio, Paolo Pacciarini, Stefano Pagani, Simone Palamara, Alice Carla Parodi, Mattia Penati, Viola Pettinati, Alessia Pini, Roberto Porcù, Marco Sarti, Marianna Signorini, Simone Stangalino, Anna Tagliabue, Nicholas Tarabelloni, Paolo Zanini.

RESEARCH ACTIVITIES

The Laboratory for Modeling and Scientific Computing MOX started its activity in 2002, with the purpose of coordinating and further developing the expertise in modeling, numerical and statistical methods present in the Department of Mathematics at Politecnico di Milano, with a focus on applications in different fields of engineering, life and social sciences.
It is currently organized in different activity groups: Advanced Numerical Methods, Applied Statistics, Biomathematics, Computational Geosciences, High Performance Computing, which reflectthe main research areas of the Laboratory, namely:

- Methods for partial differential equations in heterogeneous and complex domains; Reduction of the computational complexity; Fast solution techniques for large scale problems; Shape optimization and control problems; Computer assisted proofs.
- Statistical methods for the analysis of high dimensional and complex data; Statistical learning in biomedical context; Integration of clinical surveys and administrative databanks; Genome computing.

- Simulation of blood flow in arteries and veins; integrated models for the cardiovascular system; Modeling of the hearth; Mathematical models for nanomedicine and epigenomics; Health care management and clinical biostatistics; Clinical applications.
- Free surface flow; Fluid structure interaction; Atmospheric flows; Turbulent and reactive flows; Heat transfer.
- Numerical models for basin evolution and reservoir simulations; Flow in porous media; Geomechanics and geodynamics; Earthquake simulation; Treatment of complex geological geometries; Geostatistics.
- Development of general software libraries; Parallel computing; GPU computing.

MOX has established research collaborations with several industrial partners, among which ENI, Nolan Group, Altran, ABB, Munich Re, as well as, National and International research laboratories, among which, INGV, CMCS_EPFL, VKI, INRIA, Emory University. It maintains a strong synergy with Moxoff, the spinoff of the Department, which contributes to the technological transfer of the laboratory research.
The Laboratory hosts several PhD students of the doctoral program on Mathematical Models and Methods in Engineering and organizes courses at post graduate level as well as seminars and workshops.

FACILITIES

System of network unix workstations and HPC clusters:

- 70 workstations with linux RHES 6.X OS;
- HPC clusterof 5 quad proc nodes, Intel Xeon E5-4610v2, 160 cores, 1.2 TB RAM, OS RHES 6.5;
- HPC cluster of 15 dual procs nodes, intel Xeon X5560, 128 cores, 432 GB RAM, OS RHES 6.2;
- Hybrid CPU-GPU cluster of 4 dual procs nodes, intel Core I7-3930K, 48 cores, OS RHES 6.2, GPU Nvidisa GT520.

CURRENT AND PAST PROJECTS

http://mox.polimi.it/it/progetti/unix/?en=en

AREA DI RICERCA AFFERENTE

Numerical Analysis and Scientific Computing; Applied Statistics; Mathematical Physics.

WEB SITE

http://mox.polimi.it/

FDS Laboratory [effediesse = f(s)]

DEPARTMENT

Dipartimento di Matematica

HEAD

Prof. Giulio Magli

MEMBERS

Giulio Magli, Luisa Rossi, Paola Magnaghi, Tullia Norando, Marco Bramanti, Claudio Citrini, Elena Marchetti.

RESEARCH ACTIVITIES

Since 2000, the FDS activities aim to develop teaching strategies in order to stimulate interest in Mathematics and facilitate the transition from pre-university mathematics to that of the first year degree courses. More generally, FDS aims to promote and spread the culture of mathematics in a broad sense, emphasizing its connection with other scientific disciplines.

In the field of scientific communication and public awareness of science, FDS activities include sponsorship and/or organization of seminars, conferences, doctoral courses and other large-scale initiatives, also in collaboration with cultural institutions in Milan, in Italy and abroad.
The lab also develops partnerships and collaborations with the media (scientific magazines, radio and TV broadcasts, web-based media) in order to promote the scientific activities of the Department and to provide the advice of key experts on topics of expertise. A fundamental part of the science communication activities of FDS are the two cycles of seminars, called FDS Seminars and Mathematics and Culture.

The laboratory promotes the dissemination of mathematical knowledge through games, competitions and other initiatives. It also provides activities and support materials for the TOL, the OFA and for the teaching of Mathematics in general.

The need to represent reality with a model as universal as possible, which occurs in sciences and arts, is inspired by principles very similar to those that govern the mathematical world. The projects of Experimental Teaching of FDS are thus based on the idea of reconciling the various talents of creative processes. Projects arise as the result of a synergy between different scientific experiences - as for instance the world of astronomy or design technology – or from the dialogue with the artistic world, like graphic art, music and theatre.

FDS Laboratory has always had special consideration for its Cultural Heritage. A common “mathematical” thread unites therefore many monuments of antiquity, such as the Pyramids of Giza or the Pantheon –

whose projects are related to geometry and celestial cycles – to the great Renaissance masterpieces and also many contemporary buildings. The latter, already "monuments" for their originality of form, require a sophisticated virtual modeling, a combination of Numerical Analysis and Computer Science.

WEB SITE

http://fds.mate.polimi.it/