



## SISSA mathLab

- A laboratory for mathematical modelling and scientific computing devoted to the interaction between mathematics and its applications
- An interdisciplinary research centre powered by the interest in problems coming from the real world, from industrial applications, and from complex systems





- A team of scientists pursuing frontier research, while expanding the opportunities for a dialogue across academic and disciplinary boundaries
- A partner for companies and institutions interested in mathematics as a tool for innovation
- A research team focusing on new trend in computational mechanics, numerical analysis, mathematical modelling, numerical simulation and scientific computing

## **Related Computational Science Initiatives at SISSA**

- A new Ph.D. program: Mathematical Analysis, Modelling and Application (AMMA) www.math.sissa.it
- A new master in High Performance Computing (MHPC) www.mhpc.it
- A new supercomputer centre in Miramare: Ulysses cluster (100TFlops)
- 18 people involved:
- 4 Faculty members (Director: Prof. A. DeSimone, Head Scientific Committee: Prof. A. Quarteroni)
- 7 Researchers
- 7 Ph.D. / Master / Exchange students

## SISSA mathLab Core Activities

- Innovative boundary element/finite element techniques, targeted to the solution of complex PDEs on high performance computing facilities, with focus on the industrial needs of the territory
- Iso-geometric analysis techniques, to exploit the same functional description used in industrial CAD tools for the analysis of PDEs, bridging the gap between design and analysis



- Reduced Order Modelling techniques, such as Reduced Basis Methods or Proper Orthogonal Decomposition, for the efficient solution of complex parametrized systems held by Partial Differential equations: focus on optimization and control problems in continuum mechanics (CFD, thermal analysis, fluid-structure interaction)
- Offline-Online Computing to export intensive calculations performed on supercomputers for some selected parameters configurations (bases) into online devices to perform real-time computing (optimization, control) for industry and medicine, for example



- Cell crawling and swimming motility study through a combination of experiment, mathematical modelling, and numerical simulation
- Prototypes of bio-inspired motile robots, based on the principles distilled from the mathematical modelling of biological organisms
- Study of cell motility with detailed microscopic models of the mechanics of the cytoskeleton and with macroscopic models based on the notion of active liquid crystals



## Current SISSA mathLab collaborations and projects



WEB: mathlab.sissa.it

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