MATHEMATICAL ROBOTICS

In the last decades the field of robotics has largely been developed and has reached a certain level of the overall maturity. Meanwhile, many long-standing open problems still persist and await further advances, whereas perpetually broadening the scope of applications of robotics gives rise to performance standards higher than those met by existing solutions. Moreover, emergence of new types of intelligent automata, critical shifts in paradigms about their usage and cooperation, and ideas on novel applications systematically put new scientific and engineering challenges on the agenda.

From the very inception of robotics, one of their pillars is not only consumption of extended mathematical and computational tools but also intertwining developments in mathematics with advances in technology. Nowadays it is beyond doubt, more or less, that while some of the obstacles in cutting-edge robotics are technological in nature, other substantial obstacles stem from the lack of well-developed mathematical tools to model and solve underlying problems.

New challenges faced by robotics motivate to break the tradition in which roboticists largely act as users of mathematical tools and results and to energetically shift towards their more active role in shaping and creating novel, yet specialized, tools and results and in identifying general problem statements and whole research directions to be shared by experts from various concerned communities.

The Open Invited Track aims at bringing together researchers concerned with all branches of robotics in order to highlight, share, disseminate, and foster substantial and critical mathematical content, methods, ideas, perspectives, needs, and challenges in the field, along with relevant recent high-quality results. The participants are also expected to identify fundamental and significant areas of robotics research and the mathematical tools needed to solve problems therein. This track is expected to add new dimensions and bring a new impetus to the developing area of mathematical robotics.

With no topical preferences being pre-established, the following subject areas are, in particular, targeted and welcomed:

- Cognitive robotics, mathematical aspects of robotics, developmental robotics, neuroscience based approaches to robotics.
- Safe and computationally effective sensor-based autonomous navigation (including that in 3D) of mobile robots and their ensembles with provable global convergence.
- Autonomous path planning (in particular, for multi-body and modular robots) and deployment of robotic networks; geometric and topological aspects, methods, tools, relevant results and developments.
- Mathematical modeling, kinematics, and dynamics issues relevant to the area.
- Modern developments in optimal control and optimization relevant to the topical area.
- Sliding-mode, Lyapunov's, adaptive and other mathematical techniques in control of robots, with guaranteed satisfaction of the robots goals.
- Combinatorial, statistical, and stochastic approaches, including those in statistical learning and distributed decision making.
- Fundamental problems in manipulation (including non-prehensile one) of compliant objects in contact with compliant environments by robotic hands and tools.