Program

	Monday 15/06	Tuesday 16/06	Wednesday 17/06	Thursday 18/06	Friday 19/06
9:00 – 10:30 (1h30)	Kinematics & statics Plenary Lecture Speaker : M. Carricato	Uncertainties Plenary lecture Speaker : J. P. Merlet	Control Plenary Lecture Speaker : A. Chemori	Cable-Driven // Robots Plenary Lecture Speaker: M. Gouttefarde	Cable-Driven // Robots Plenary lecture Speaker : T. Bruckmann
10:30 – 11.00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:00-12.30 (1h30)	Kinematics & singularity Plenary lecture Speaker : S. Caro	Design Plenary Lecture Speaker : O. Company	Haptics & Rehabilitation Plenary Lecture Speaker : A. Frisoli	Humanoids & PKMs Plenary Lecture Speaker : A. Parmiggiani	Biomechanics Plenary Lecture Speaker : N. Sancisi
12:30 – 14:30	Lunch	Lunch	Lunch	Lunch	Lunch
14:30 – 16:00 (1h30)	Dynamics Plenary Lecture Speaker : A. Müller	Grasping Plenary Lecture Speaker : J. Borras	Social Event	Industrial issues Plenary Lecture Speaker : SYMETRIE	Project Simulation lab
16:00 – 16:30	Coffee break	Coffee break		Coffee break	Coffee break
16:30 – 18:00 (1h30)	Project Simulation lab	Project Simulation lab		Project Simulation lab	Project Simulation lab

Admission

The number of participants is restricted to 45. Priority will be given to Ph.D. students and Post-docs from the European Community. But a significant number of researchers and professionals, as well as students from other countries may also be accepted.

The registration includes two steps. A preregistration is required before the **31st of January 2020**, where a scientific committee will select the candidates based on their CVs. Accepted participants should proceed to final registration by the **29th of February 2020** on:
http://www.lirmm.fr/pkm-2020/registration/

Meal expenses (including lunches and coffee breaks) will be supported by the organizers thanks to sponsor funding and participants registration fees. Participants must cover their own travel and logging expenses.



Contact

For further administrative information, please contact:
comunicazione@fondazionealmamater.it

For further scientific information, please contact:
Marco Carricato (marco.carricato@unibo.it)
Ahmed Chemori (ahmed.chemori@lirmm.fr)

Sponsorship

Symétrie

IFToMM

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

LIRMM

3rd Summer School On Parallel Kinematic Manipulators

PKM 2020

June 15-19, 2020
Bologna (Italy)

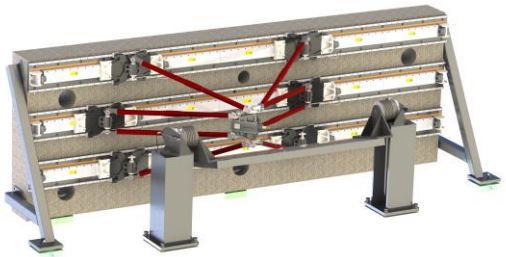

Image: ARROW PKM ©: LIRMM

Coordinated by
Marco Carricato DIN – ICIR MAM – University of Bologna, Italy
Ahmed Chemori LIRMM, CNRS – University of Montpellier, France

www.lirmm.fr/pkm-2020

Parallel Kinematic Machines

The Robotics community has devoted a considerable amount of research efforts on parallel kinematics machines in the past four decades. This interest was motivated by clear performance improvements compared to conventional serial robot architectures, such as anthropomorphic, SCARA or gantry robots. Parallel kinematics systems have demonstrated higher performances in:

- dynamic capabilities in terms of high accelerations (up to 1000 m/s^2 accelerations have been reached by prototypes, pushing the limits of mechanics, control and actuators),
- high payloads, where hexapods can lift today several tons and position them accurately with six degrees of freedom,
- increased stiffness.

The scientific community has addressed many research topics, such as Kinematics, dynamics, singularities, uncertainties, type and dimensional synthesis, control, simulation, calibration, identification, mechanical design, technology, performance indices, reconfigurable devices, and experiments.

A good control of these issues is requested to obtain a convincing running prototype, with potential applications in industry.

As a short list of products that have reached the industrial market, one can mention:

- Hexapods or hexapod-like robots (also known as Gough, Stewart or Gough-Stewart platforms). Among them we can mention some products by PI, Symétrie and or Fanuc,
- Delta or Delta-inspired robots, originally licensed to ABB (Flexpicker), now available from several manufacturers (Fanuc, Codian Robotics, SIG Pack Systems, Panasonic, etc.),
- Tricept (Neos Robotics) and Exechon (Exechon AB),
- Quattro, Hornet (Adept).

Despite the substantial research effort devoted to this domain, only a few products are currently available on the market. The main explanations lie, on the one hand, in the fact that parallel robots can seem complex and require significant analytical investigations to be made operational. On the other hand, the knowledge obtained by academic research often focuses on specific sub-domains and is rarely integrated into comprehensive and readily practical frameworks. Moreover, when prototypes or demonstrators are built, the goal is usually to validate theories through experiments, rather than to convince industrial stakeholders to invest in future products or applications. Nevertheless, some demonstrators meet industrial applications.

From a research point of view, the theory of PKMs has to face technological limitations in terms of:

- industrial control systems,
- active and passive joints integration,
- collision avoidance.

The goal of PKM 2020 is to share the knowledge on parallel kinematic machines design, modelling and control during a whole week, targeting realistic prototypes and to face real problems met by industry.

The courses are divided in plenary lectures and simulation labs. They are addressed to PhD students, post-docs and researchers already involved in the area or interested in parallel kinematic machines. Basic background in mechanical, computer science, control and electrical engineering is recommended.

Content

Different session formats will be planned:

- plenary lectures by invited international speakers,
- plenary lectures by local speakers and industrials,
- project sessions with simulation labs.

The topics tackled during the sessions include:

- Kinematics,
- Dynamics,
- Design,
- Grasping, haptics and rehabilitation,
- Control,
- Simulation (with Matlab/Adams coupling),
- Special sessions on cable driven parallel robots.

Invited lecturers

Chosen among the most well-known experts worldwide, the lecturers have a significant theoretical and practical background in PKM community:
Júlia Borràs, Polytechnic University of Catalonia, Spain
Tobias Bruckmann, University Duisburg-Essen, Germany
Andreas Müller, Johannes Kepler University Linz, Austria
Antonio Frisoli, Scuola Superiore Sant'Anna, Italy
Alberto Parmiggiani, IIT, Italy
Nicola Sancisi, University of Bologna, Italy
Marco Carricato, University of Bologna, Italy
Jean-Pierre Merlet, INRIA, France
Stéphane Caro, LS2N, CNRS, France
Ahmed Chemori, **Olivier Company, Marc Gouttefarde,** LIRMM, UM/CNRS, France

Lectures and school materials

All lectures will be given in English. The lecturers' slides will be available online at class time. *The students are advised to bring their own laptop with a running Matlab version and a "student version" of ADAMS software.*

Scientific committee

Marco Carricato, University of Bologna, Italy
Olivier Company, LIRMM, UM/CNRS, France
Marc Gouttefarde, LIRMM, UM/CNRS, France
Sébastien Krut, LIRMM, UM/CNRS, France
Ahmed Chemori, LIRMM, UM/CNRS, France
Stéphane Caro, LS2N, CNRS, France
Sébastien Briot, LS2N, CNRS, France

Venue & Accommodation

All the lectures will be given at the School of Engineering, University of Bologna, Viale Risorgimento 2, Bologna, Italy
http://www.lirmm.fr/pkm-2020/venue/

The participants may find some suggestions for accommodation on the website of the school at:
http://www.lirmm.fr/pkm-2020/

Thank you for helping to keep Italy tidy. Please do not litter.