Preliminary program (May 5th, 2009)

	Tuesday, Sept 8	Wedn., Sept 9	Thursday, Sept 10	Friday, Sept 11	Saturday, Sept 12	Sunday, Sept 13	Monday, Sept 14	Tuesday, Sept 15	Wedn., Sept 16
8:30-9:00		Opening							
9:00-10:30		Introduction to surgical robotics *E. Dombre*	Technical I Robotics & urology *J. Troccaz*	Medical Imaging (Basic) *Guang-Z Yang*	... Industrial forum *(LIRMM)*		Technical II *I. Sakuma*	Medical III Orthopedics *E. Stindel*	Medical V NOTES *A. Cuschieri*
11:00-12:30		Design & Safety *O. Company / S. Krut*	Simulation & Haptics *O. Clatz*	Medical Imaging (Advanced) *Guang-Z Yang*	LIRMM demonstrations *(LIRMM)*		Technical III *R. Taylor*	Medical IV *M. Hagen (to be confirmed)*	Future trends in surgical robotics I *P. Dario*
12:30-14:30		Official Lunch	Lunch	Lunch	Free afternoon	Sightseeing tour	Lunch	Lunch	Lunch
14:30-16:00	Installation at Hotel Citadines	Robot registration *J. Troccaz*	Control II *J. Gangloff*	Industrial forum *(CRDP)*			Medical I *M. Hashizume*	Technical IV *M. Schurr (to be confirmed)*	Future trends in surgical robotics II *P. Dario*
16:30-18:00		Control I *P. Poignet*	Design & Haptics *B. Hannaford*				Medical II Abnominal surg. *L. Soler*	Technical V *G. Morel*	Students' presentations
18:00-19:00		18:30 Visit of Montpellier	Students' presentations				Students' presentations	Students' presentations	Evaluation and closing session
			19:30 Cocktail, City of Montpellier						

Admission

The number of participants is restricted to 50. 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 extra-EC countries will be accepted.

Applicants must fill the application form (www.lirmm.fr/UEE09/registred.php) by June 15th, 2009. A scientific committee will select the candidates. A letter of confirmation will be sent to accepted participants.

The lodging expenses will be partially supported by the organizers depending on fundings, the complement being provided by the participants. The travel will be at the participants' own expenses. The organizers will offer the lunches and the sightseeing tour.

For further administrative information, please contact Céline Berger / Caroline Imbert, LIRMM, berger@lirmm.fr / cimbert@lirmm.fr

For further scientific information, please contact Etienne Dombre / Philippe Poignet, LIRMM, dombre@lirmm.fr / poignet@lirmm.fr

Laboratoire d'Informatique de Robotique et de Microélectronique de Montpellier

LIRMM

Surgical Robotics

4th Summer School

Coordinated by
Etienne Dombre and Philippe Poignet
LIRMM, CNRS-Université Montpellier 2

Montpellier (France) / September 9-16, 2009

www.lirmm.fr/UEE09

ARAKNES European project (IP-ICT- 2007-2 # 224565)
Ministère de l'Education Nationale, de l'Enseignement Supérieur et de la Recherche (to be confirmed)
Centre National de la Recherche Scientifique (CNRS)
Conseil Général de l'Hérault
Région Languedoc Roussillon
Pôle Universitaire Européen de Montpellier
Université Montpellier 2, Ecole Doctorale I2S,
Ville de Montpellier

Surgical robotics

Robotics enables surgery to be less invasive and/or to enhance the performance of the surgeon. In minimally invasive surgery (MIS) for instance, robotics can improve the dexterity of conventional instruments, which is restricted by the insertion ports, by adding intra-cavity degrees of freedom. It can also provide the surgeon with augmented visual and haptic inputs. In open surgery, robotics makes it possible to use in real time pre-operative and per-operative image data to improve precision and reproducibility when cutting, drilling, milling bones, to locate accurately and remove tumours… In both cases, as in other surgical specialities, robotics allows the surgeon to perform more precise, reproducible and dextrous motion. It is also a promising solution to minimize his fatigue and to restrict his exposition to radiation. For the patient, robotics surgery may result in less risk, pain and discomfort, as well as a shorter recovery time. These benefits explain the increasing research efforts made all over the world since the early 90's.

Surgical robotics requires great skills in many engineering fields as the integration of robots in the operating room is technically difficult. It induces new problems such as safety, man-machine cooperation, real time sensing and processing, mechanical design, force and vision-based control… However, it is very promising as a mean to improve conventional surgical procedures, for example in neurosurgery and orthopedics, as well as providing innovative new ones in micro-surgery, image-guided therapy, MIS and now Natural Orifice Transluminal Endoscopic Surgery (NOTES).

The highly interdisciplinary nature of surgical robotics requires close cooperation between medical staff and researchers in mechanics, computer technology, control and electrical engineering. This cooperation has resulted in many prototypes for a wide variety of surgical procedures. A few robotics systems are yet available on a commercial basis and have entered the operating room namely in neurosurgery, orthopedics and MIS.

Depending on the application, surgical robotics gets more or less deeply into the following fields: multi-modal information processing; modelling of rigid and deformable anatomical parts; pre-surgical planning and simulation of robotic surgery; design and control of guiding systems for assistance of the surgeon gesture. These fields will be addressed by surgeons and researchers working in leading hospitals and labs. They will be completed by engineers who will give insight into practical integration problems.

This course is addressed to PhD students, post-docs and researchers already involved in the area or interested by the new challenges of such an emerging area interconnecting technology and surgery. Basic background in mechanical, computer science, control and electrical engineering is recommended.

This Summer School follows three previous editions held in 2003, 2005 and 2007, also in Montpellier, (visit www.lirmm.fr/manifs/UEE/accueil.htm, www.lirmm.fr/UEE05/, www.lirmm.fr/UEE07/).

Content

The lectures will be organized in four parts:

- *Fundamental aspects of surgical robotics (2.5 days):* medical imaging, modelling, control, design and safety, planning and registration, haptics;
- *Applications (2 days):* technical point of view (from design to experiment), and surgical point of view (orthopedics, neurosurgery, cardiovascular surgery, abdominal surgery);
- *Industrial forum (1 day)* with exhibition of equipments, presentations of applications, and demonstrations; visit of the LIRMM facilities;
- *Future trends (1 day):* perspectives in small size robots and mechatronic devices for surgery and therapy; perspectives in NOTES.

Time will be reserved for the participants to present their own research work.

Invited lecturers

Chosen among the most well-known experts worldwide, the lecturers have a significant theoretical and practical background in Surgical Robotics. They represent the clinical, scientific and engineering communities:

- **Olivier Clatz,** INRIA, Sophia Antipolis, France
- **Olivier Company**, LIRMM, Montpellier, France
- **Alfred Cuschieri**, Scuola Superiore Sant'Anna, Pisa, Italy
- **Paolo Dario**, Scuola Superiore Sant'Anna, Pisa, Italy
- **Etienne Dombre**, LIRMM, Montpellier, France
- **Monika Hagen**, Geneva University Hospital, Switzerland
- **Blake Hannaford**, Washington University, Seattle , USA
- **Makoto Hashizume**, Kyushu University, Fukuoka, Japan
- **Sébastien Krut**, LIRMM, Montpellier, France
- **Jacques Gangloff**, LSIIT, Strasbourg, France
- **Guillaume Morel**, ISIR, Paris, France
- **Philippe Poignet**, LIRMM, Montpellier, France
- **Ishiro Sakuma**, BPME, Tokyo University, Japan
- **Marc Schurr**, Novineon, Tuebingen, Germany
- **Luc Soler**, IRCAD, Strasbourg, France
- **Eric Stindel**, CHU-LATIM, Brest, France
- **Russ Taylor**, John Hopkins University, Baltimore , USA
- **Jocelyne Troccaz**, TIMC, Grenoble, France
- **Guang-Zhong Yang**, Imperial College, London, UK

Lectures and school materials

All lectures will be given in English. Copies of the lecturers' slides will be available at the time of the class. All the School material (including slides of students' presentations) will be available by the end of September on the website of the LIRMM together with copies of significant papers of the lecturers as well as videos.

ECTS

The 36-hour courses of the Summer School will be accredited by the *Doctoral School on Information, Systems and Structure* (I2S) of the University of Montpellier 2 (a *Doctoral School* in the French Universities manages the Ph.D. degree). 5 ECTS credit points will be awarded to student attendees.

Accommodation

The lectures will be given in the "Centre Régional de Documentation Pédagogique", which is located downtown Montpellier (map on www.lirmm.fr/UEE09/get.php). For convenience, the exhibition and demos will be organized within the experimental facilities of LIRMM. The students will be housed in apartments shared by two or three of them, in the residence "Les Citadines – Antigone", at walking distance from CRDP.