Report Newsletter

www.stiff-flop.eu

December 2012

STIFF-FLOP Workshop on the Development of Robot-based Cardio Surgery, at the Foundation of Cardiac Surgery Development, Poland

All project partners were invited to the workshop organised by the Foundation of Cardiac Surgery Development (FRK). The workshop was held from 4th-6th December 2012 in Zabrze, Poland. The consortium took the opportunity to arrange an updated ROS workshop and a technical STIFF-FLOP meeting in conjunction with this event. The main focus of this workshop was on surgical tools for minimally invasive surgery, including training on several surgical techniques and tools as well as a presentation of the Robin Heart robot. In order to demonstrate medical training techniques during this meeting the project partners visited the most modern pre-clinical education's facility in Poland – the Didactics and Medical Simulation Centre.

During this workshop, partners were invited to the Medical Robots Conference on the 6th/7th December at FRK and in the Silesian Centre for heart diseases where benefits and problems of various operation tools were discussed and perspectives of transanal surgery and transgastric surgery were presented. As a special highlight, the Silesian Center for heart diseases presented two live surgeries where the project partners could monitor the complete operation of a minimally invasive replacement of an aortic valve as well as a complete minimally invasive atrial ablation procedure with a special focus on the live usage of minimally invasive tools.
Afterwards, the project partners had the possibility to train the use of different surgical tools used in minimally invasive surgery.

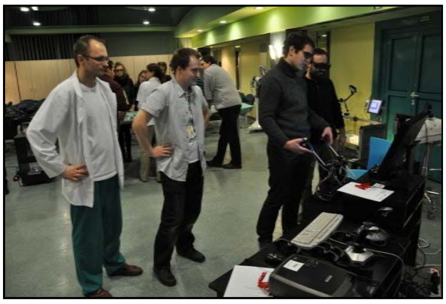

Figure 1: Workshop at FRK, Participants at training stations.

Figure 2: The Robin Heart robot surgery system

Figure 3: The STIFF-FLOP team at the workshop in Zabrze

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SSSA: Advancements on the Manipulator

The Scuola Superiore Sant'Anna (SSSA) made notable progress concerning the STIFF-FLOP manipulator hardware. The main component of the manipulator module is an elasto-meric cylinder. This material has been found to guarantee the right level of softness when deformed passively and it is suitable to host internal chambers that can be used to modulate the characteristics and the behaviour of the module. The cylindrical elastomer hosts three embedded chambers which are arranged in a radial fashion. The embedded chambers are connected to a multi-valve system that can vary the internal pressure of the chambers (Figure 4).

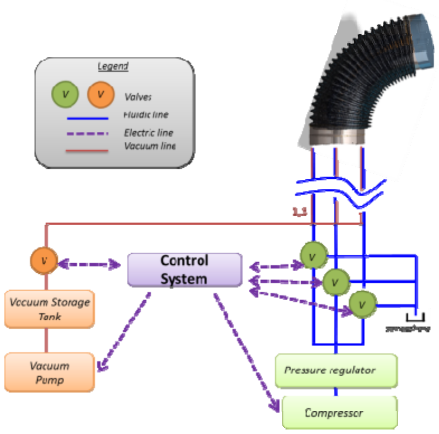


Figure 4: STIFF-FLOP module actuation system

The air pressure source can expand the chambers causing a shape change. Thanks to the action of this fluidic actuation each pressurized chamber can bend the structure in the outward direction (due to their spatial arrangement) and the combined action of multiple chambers being activated simultaneously can generate an omnidirectional bending. Moreover,

Figure 5: Multi-directional bending

by tuning the source pressure, the amplitude of the bending can be modulated (Figure 5).

The elongation of the module can be achieved by inflating all the three chambers simultaneously: their bending forces generated by the chambers are antagonistic and nullify each other; thus the net

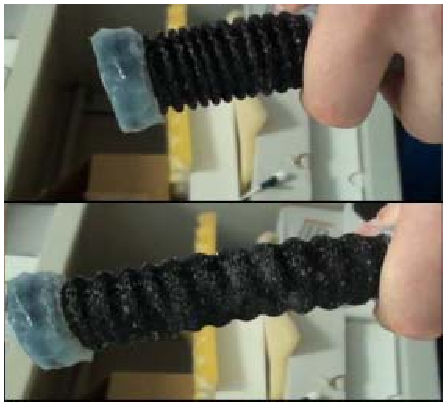


Figure 6: Elongation

balance of the forces has only a longitudinal component that translates into an elongation (Figure 6).

Variations in the stiffness of the module can be achieved exploiting an approach called granular jamming. In our case, this mechanism has been implemented with a central chamber hosted by a channel inside the elastomeric cylinder. This chamber is used to contain a structure composed by an elastic membrane in latex filled with granular material.

UoS: Progress on FEA Modelling

The University of Surrey (UoS) explored and developed a number of modelling approaches for the flexible STIFF-FLOP manipulator. The UoS team dealt with several candidate technologies for the development of an actuating arm to be used in minimally invasive surgery. The technologies under investigation ranged from smart materials such as shape memory alloys, as well as pneumatic and hydraulic driven hyper-elastic silicone.

Prototypes were fabricated and tested with a primary interest of the use of pneumatically actuated soft silicone. The performance of the actuating modules was characterised versus material and geometrical properties, the performance was then simulated using finite element analysis and validated against experimental results. The FEA modelling approach is utilised to try to optimise the design and material specifications to achieve better actuation that in turn would achieve an increased bending angle, increased free space for manipulator add-ons such as a locking mechanism, tools and sensors, as well as an improved geometrical response. The FEA simulation would also serve as a versatile tool for the control aspect of the project, especially to serve as a map of the actuation response versus the input parameters. The affected incorporated technologies such as the braided structure, the locking mechanism, and sensors can be added onto the FEA model for a quick and cost effective method to determine the efficiency of such technologies in relation to the actuating performance (see Figure 7). Finally the FEA model would serve as a preliminary test of the performance of the design for the intended surgical application as typical forces acting on the arm during the application can be modelled (see Figure 7).

Nylon and PET braided tubes are used to develop bellow shaped sleeves to be used to harness the actuation forces of each robot module as well as serve as a protective sheath for the core module and even incorporate sensor technologies, developed in the University of Surrey. A technique that would be able to control the physical and mechanical properties of these sleeves is developed for the fabrication of tailored sleeves for optimum performance as well as to limit any adverse effects to the biological tissue.

Further technologies currently under investigation at the University of Surrey include the development of a capacitance enabled bellow that would serve as a power source within the robotic arm for any other on-board technologies such as the cameras, surgical tools, as well serve as a bending and pressure sensor. Further research also includes the investigation of stiffening techniques that can be incorporated within the currently suggested granular jamming method.

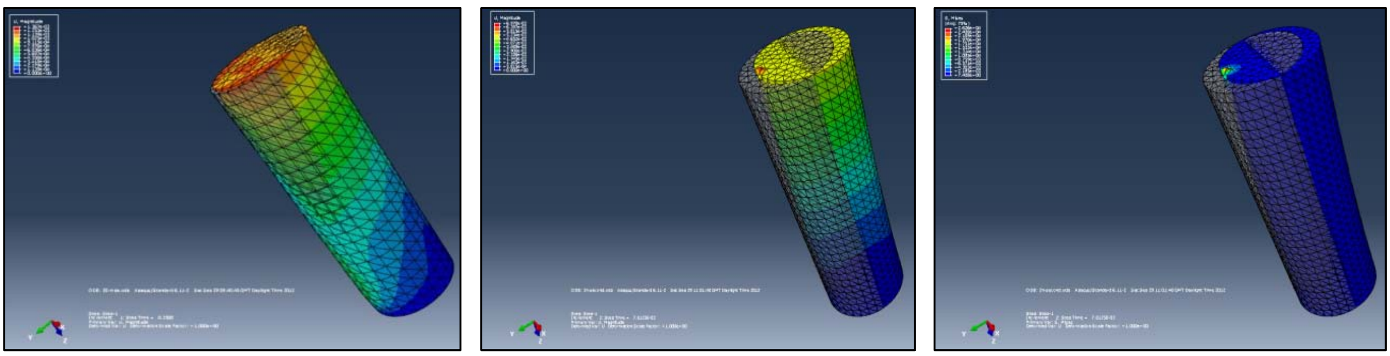


Figure 7: Schematic of a module of diameter of 25.8mm and length 80 mm with cylindrical tubes of 6.8mm diameter and a central chamber of diameter of 1 mm, results (using ABAQUS), (a) Finite element analysis stress intensity contours with actuation at 0.1 bar in one chamber with the central stiffened beam . The behaviour when none of the chambers are active with a 2N force acting normal on the beam (b) deformation contour (c) stress intensity contours

Tecnalia: Advancements on the SOFA Simulator

Tecnalia made good progress with the development of the simulations for the STIFF-FLOP arm. The SOFA simulator has been successfully connected to the overall STIFF-FLOP architecture. Now it is possible to extract the system status from the simulator, and to send back actuation requests. Thanks to the STIFF-FLOP architecture developed by Shadow, the connection of SOFA is totally transparent, so that the high level layers willing to interact with the simulator use the same commands they would do when interacting with the real system. This presents the obvious advantage of maintaining a common framework for both the real and the virtual environments, making the switch from one environment to the other easier, enabling hardware-in-the-loop testing.

We have been realizing a number of experiments on modelling the bending of robot arm modules; this is achieved by defining three forces placed on the upper part of each silicone module. On the real system, the deformation of the silicon due to the variation of pressure within the fluidic chambers is constrained by the external braided structure to take place only along the structure's longitudinal axis. The bending can thus be seen as a consequence of the variation of each fluidic chamber's length. A similar behaviour is obtained by placing forces on the upper section of the silicone module at a location corresponding to the end point of the real fluidic chambers. This simplification avoids the complex modelling of the external braided structure, while still enabling to get a satisfactory module behaviour. Such principle has been applied on one module as well as two modules connected in series, and will be now characterized to define a relationship in between the pressure used to control the real system, and the forces needed to get a similar bending in the simulator.

We are also investigating the possibility to use other modelling schemes from SOFA to improve the processing time. The arm modules are currently modelled as flexible tubes through Finite Elements Methods that tend to be quite time consuming. We consider that this aspect could be critical when more complete and complex scenes will be simulated. The study of other modelling components provided by the SOFA framework could help us in reducing the computational load, and therefore improve the system's reactivity.

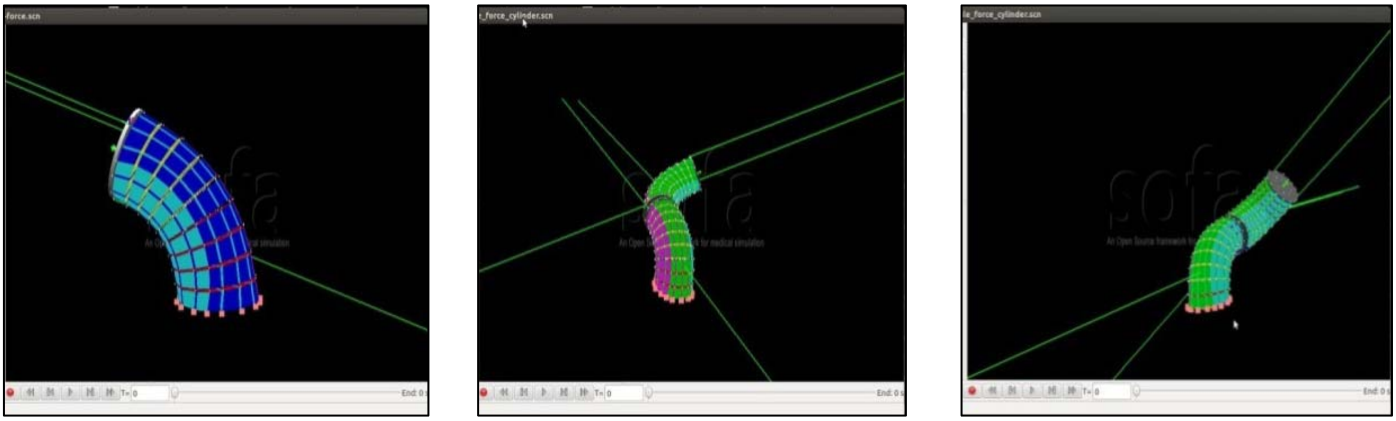


Figure 8: Example of bending realized with the simulator on one and two modules.

UoS: Real Time Controller Design

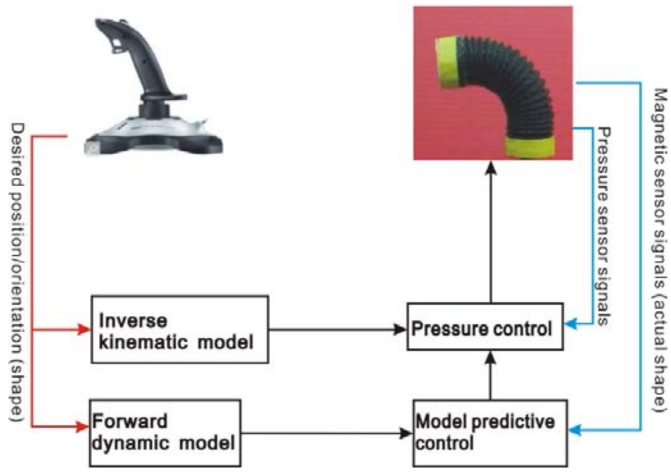


Figure 9: Structure of the single-module control system.

At the University of Surrey, a number of advances were made with regards to developing the optimal control strategy for the flexible STIFF-FLOP arm. The current work of the UoS team in WP4 is focused on the real-time controller design of a single module. As shown in Figure 9, the system involves three controllers that work at different levels:

Low level: **Pressure control with close loop**.

The pressure control loop controls the pressure of the three chambers. For the pneumatics circuit of each chamber, there is a pressure sensor and two solenoid valves (one for filling the chamber, the other for emptying). Once receiving the pressure commands from the mid or high level (i.e., the “inverse kinematic model” block and the “model predictive control” block in Figure 1), the pressure controller drives the valves of each chamber to stabilize its pressure at the requested value.

Middle level: **Coarsely controlling the bending/shape with a kinematic open loop.**

An inverse kinematic model is identified from the experimental data, which represents the relationship between the bending / shape and the air pressures of the three chambers. When receiving the desired position / orientation from the joystick, the controller in this level calculates the appropriate pressures of the three chambers using the kinetic model, and sends these pressures as the commands to the low level pressure control.

High level: **Finely controlling the bending/shape with Model Predictive Control (MPC).**

As the middle level is open loop control, it can only drive a single module into the neighbouring area of the desired bending / shape due to inevitable disturbances and uncertainties of the pneumatics system. Once the single module enters this neighbouring area, the system switches to high level fine control using MPC, which is also a closed loop controller using as input the actual bending / shape obtained from a magnetic sensor at the tip of the single module (see Fig. 8). The task of the MPC module is to control the bending / shape accurately and robustly in this small neighbouring area. The MPC module uses a dynamics model of the single module and an online optimization algorithm to compute the pressure commands for the pressure controller. MPC was conventionally developed for slow systems like chemical processes. We are continuing to analyze various MPC algorithms in order to design an efficient algorithm that can run at the fast sample rate of our real-time system. As an alternative, we are using a simple Proportional-Derivative controller at the high level in current experiments for testing the whole system.

In the experiment shown in Figure 10, the bending angle of the single module is controlled following the movement of the joystick.

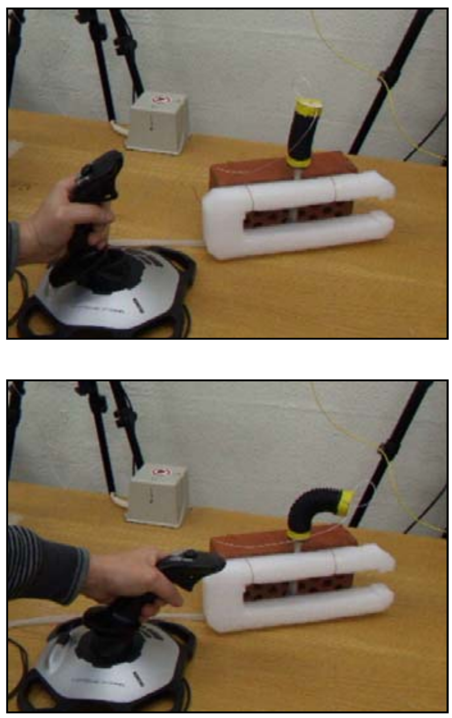


Figure 10: The bending angle of the single module is controlled with a joystick.

IIT: Cognitive Development in Bio-inspired Manipulators

IIT made tangible advancements concerning the cognition in bio-inspired, flexible manipulators. The aim of cognitive development is to assist the surgeon during the surgical task. While the doctor controls the end-effector, moving within organs to reach remote areas inside the body, the motion of the whole arm is regulated by the high level cognitive modules that autonomously control the flexibility and the configuration of the robot body.

The correct behaviour of the module is obtained by transferring the needed skills from surgeons to the robot. These behaviours cannot be hard coded, since the surgeon should not be distracted by tasks involving the observation and precise steering of these behaviours that often change depending on the task and context. Machine learning tools are used to extract the relevant features from the observation of the surgeon while performing the needed tasks and to encode them into a statistical model.

This is not limited to a purely mimicked behaviour, but consists of extracting and reproducing the intents underlying the actions. For this purpose, the extracted aims are described as a context dependent reward function, that the robot has to maximize during the task.

Within the progress of Task 3.2, IIT and KCL started to develop algorithms that are able to learn a context dependent reward function from the demonstrations given by an expert user. Some preliminary experiments were run in simulation on a 2-d model of a flexible manipulator moving among simulated organs (Figure 11).

The cognitive module was able to learn two different behaviours for the robot arm, depending on the forces that the organs transfer to the manipulator. When they are high, the robot learnt to dampen the vibration and to slide along the organs without pushing on them; in a low force context, the robot is far from the organs and it learnt to track the given trajectory with a higher accuracy, as shown in Figure 12. For this purpose, the reward function is represented as a weighted sum of distinct reward functions, each encoding a different aim: the weights represent the importance of each reward for the task within the given context.

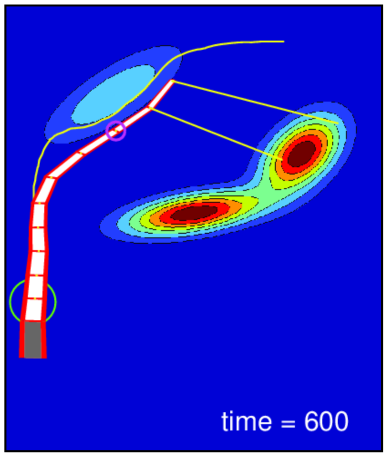


Figure 11: The 2D model of the manipulator used for testing the learning algorithm. The manipulator moves among organs with the context dependent transferred skill.

Future progress envisaged: The algorithms will be used to transfer skills to the model of the STIFF-FLOP manipulator in the SOFA simulator.

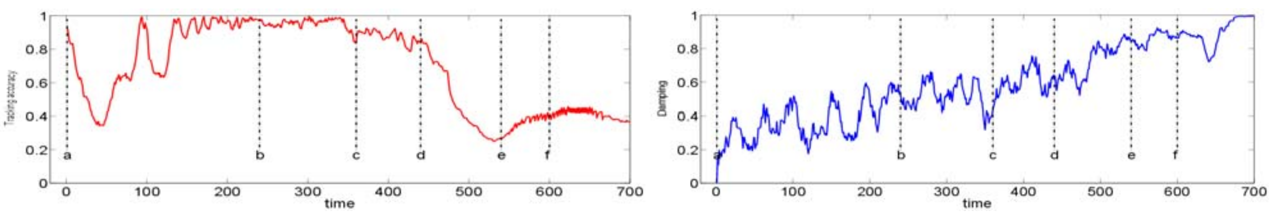


Figure 12: Schematic of a module of diameter of 25.8mm and length 80 mm with cylindrical tubes of 6.8mm diameter and a central chamber of diameter of 1 mm, results (using ABAQUS), (a) Finite element analysis stress intensity contours with actuation at 0.1 bar in one chamber with the central stiffened beam . The behaviour when none of the chambers are active with a 2N force acting normal on the beam (b) deformation contour (c) stress intensity contours.

Kings-CoRe.com

The Centre for Robotics Research launched a new website in October 2012. Next to Prof. Kaspar Althoefer, Prof. Lakmal Seneviratne, Dr Thrishantha Nanayakkara and Dr Hongbin Liu, CoRe members also include Prof. Jian Dai, Dr H.-K. Lam, and Dr Michael Spratling and their research teams. STIFF-FLOP is one of the featured EU projects on the new CoRe website.

Figure 13: Screen shot of the new CoRe website.

hapTEL-X Meeting, Guy's Campus, King's College London

CoRe is collaborating with colleagues from the King's College London Dental Institute on a project called hapTEL-X to apply for new grants. This project has arisen from the former hapTEL™ project which was to design, develop and evaluate a virtual learning system which includes haptic and synthetic devices.

This hapTEL™ virtual system is used initially in dentistry with design focused on enhancing learners' 3D perceptions, manipulations and skills, and relates these to concepts needed in preparing 3D virtual tooth cavity. The devices is integrated into the curriculum to evaluate the extent to which Technology Enhanced Learning can enhance the quality of learning and the kinds of pedagogical practices that will emerge around innovation with TEL. New ideas for hapTEL-X will study related haptic challenges such as the simulation of needle injections simulations. Haptics knowledge gained as part of this collaboration has great potential to cross-fertilise the haptics developments of STIFF-FLOP.

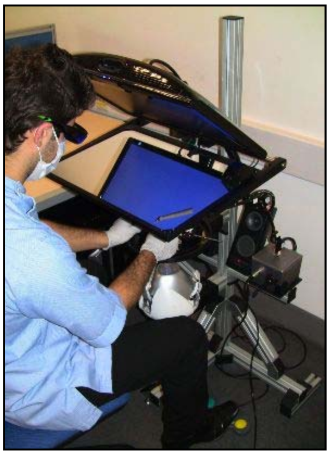


Figure 14: The hapTEL™ virtual system

STIFF-FLOP Technical Meeting at the Scuola Superiore Sant Anna, Pisa, Italy

The STIFF-FLOP consortium held a technical meeting at SSSA in Pisa in order to review the progress of the project. During this meeting on October 1st and 2nd, each partner presented their research and discussions between biologists, surgeons and engineers took place to move the project towards a successful completion of the first year. This face-to-face meeting also gave the possibility to visit the labs and to provide an insight into other on-going projects at SSSA including the OCTOPUS project (www.octopus-project.eu).

Figure 15: The STIFF-FLOP consortium at SSSA

Figure 16: Lab tour with Prof. Arianna Menciassi

STIFF-FLOP ROS Workshop and Technical Meeting at the Foundation of Cardiac Surgery Development, Zabrze, Poland

During the FRK workshop early December, Ugo Cupcic (Shadow) and Anthony Remazeilles (Tecnalia) held a ROS workshop in order to update all partners with the current system map and the SOFA simulator.

A technical meeting was also planned. Each WP leader introduced the work achieved during the past months. The consortium agreed on an action list which will show the work to be accomplished for the review meeting in April 2013 at IIT in Italy.

Figure 17: The STIFF-FLOP consortium at FRK

UNITO: Safety Issues for Patients and Surgeons

Safety has been considered an important aspect for the STIFF-FLOP project. UNITO with input from EAES have analyzed the state of the art of current laparoscopic and endoluminal surgical procedures, regarding possible applications of the STIFF-FLOP technology.

We performed a first meta-analysis focusing on rectal cancer treatment and comparing laparoscopy to open surgery. We could demonstrate that laparoscopy, although still not very much prevailed for this application, represents an advantage in terms of reduced 30 days morbidity and mortality, even in the subgroup of patients with an extraperitoneal rectal cancer, i.e. located in the very distal and narrow part of the pelvis. Laparoscopy can therefore be defined to be safer for the patient than open surgery. Unfortunately, laparoscopic treatment of rectal cancer is considered in general a technical challenge, so that the currently available robotic technology (da Vinci, Intuitive Surgical, CA, USA) has been proposed. In a further meta-analysis commissioned to Dr Kim, Department of Surgery, Korea University College of Medicine in Seoul, it is illustrated how currently the robotic approach reduces only the risk of conversion from laparoscopy to open surgery, representing therefore a minimal achievement for an expensive technology used for oncologic purposes, with no advantage in safety for the patient.

Single Port Surgery was object of a further meta-analysis comparing it to standard laparoscopy and we could demonstrate an increase of operative time, underlining an increase in technical challenge, confirmed by a trend towards an increase in 30 days morbidity, although not statistically significant, with a minor cosmetic advantage and no reduction of pain. In other words, current technology is insufficient to replicate advantages of laparoscopy when a single port approach is used.

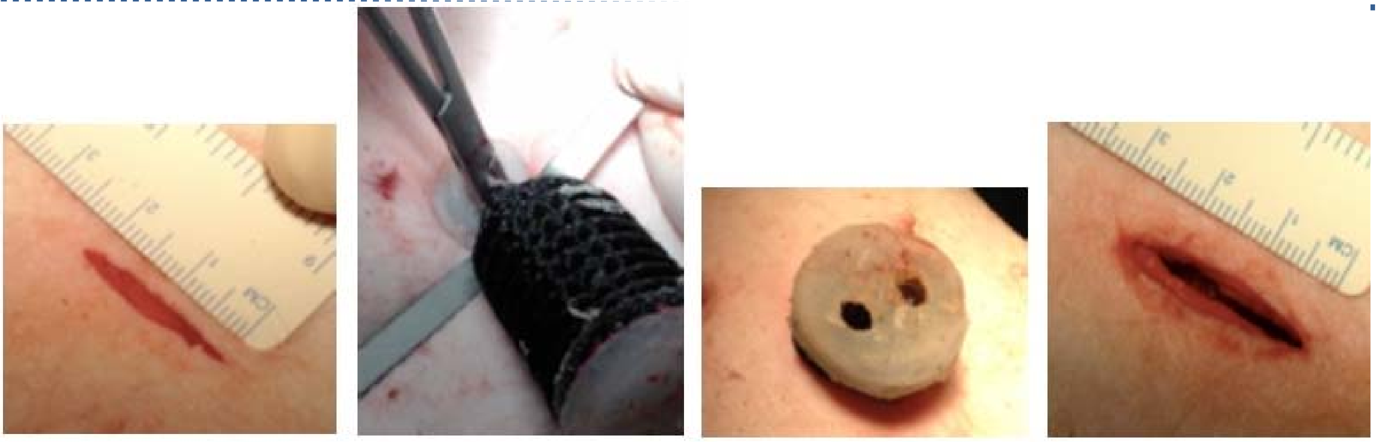
Finally, endoluminal applications were explored. In a single arm meta-analysis of case series for the treatment of suspected benign large sessile rectal lesion, we could demonstrate a clear advantage of Transanal Endoscopic Microsurgery (TEM) through a rigid rectoscope versus Endoscopic Submucosal Dissection (ESD) performed via flexible endoscopes, the second approach increasing the risk of major abdominal surgery for oncologic reasons (up to a 5 folds rate), this way representing a clear reduction of safety for the patient. Nevertheless TEM technology is obsolete and entails a surgical OR environment including general anaesthesia.

Figure 18: EASIE-R simulator with NOTES animal inserts

We then analyzed safety issues through the currently available technology specifically developed for the STIFF-FLOP project, designing precise tests on phantoms with animal inserts. The simulator is equipped with real skin surface and internal organs in the so called NOTES configuration (Figure 18).

In this first test phase we tested four different prototypes of the STIFF-FLOP arm with different surface materials. Safety tests were performed exploring three different aspects:

1. **Insertions through the abdominal wall:** The aim was to investigate the capability to squeeze and pass through a 20 mm port (Figure 19).



20 mm incision of the abdominal wall

introduction of the module with the aid of a kelly forceps to squeeze the distal tip shape

complete introduction of the module

skin enlargment uto to 25 mm, and minimal sign of tissue crashing

Figure 19: EASIE-R simulator with NOTES animal inserts

2. **Scratching tests:** Detecting micro- and macro-modifications of the surface of abdominal organs (stomach, spleen, liver, bowel) after perpendicular scratching at different pressures (2N, 3N and 5 N approx.) was the purpose of these tests (Figure 20).

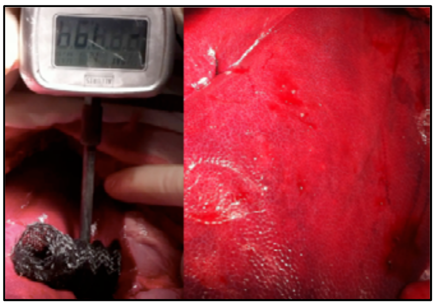


Figure 20: a) Newton-meter pressed at about 2N over the surface of the liver; b) spot bleeding on the liver surface

3. **Gravity force tests:** The aim was to investigate if any of the currently available arm sheaths could impact on safety while sliding over abdominal organs surface even in absence of force if not gravity (Figure 21).

Safety tests proved that a 20 mm skin and full thickness wall incision is sufficient to introduce the currently available prototype module, sized about 40 mm in diameter, into the abdomen by squeezing the device with the help of a surgical forceps, with minor effects on the surrounding skin, compatible with standards of single port technology.

Moreover, the white nylon sheath seemed absolutely atraumatic even when pressed at high perpendicular forces (5N) against delicate surfaces like liver and spleen, and moved over, while both the white sheath and the grey 2 sheath, also in nylon, when covering the scope could slide over the surface of internal abdominal organs under simple gravity conditions.

Figure 21: white sheath performing a gravity force test over the stomach surface

Future perspectives: Well before human applications, the developed device will undergo extensive testing analyses in several phases, including dry-lab, wet-lab and cadaveric lab. Tests will include range of motion within a restricted field, movement precision accuracy, inadvertent movements, force measurement and tissue resection appropriateness. Potential complications such as tissue trauma or bleeding that could be caused by the device will be exhaustively investigated. Hardware and software malfunction causing in vivo breakdown of the robotic system will be taken into account. Movement precision accuracy will be tested by performing a series of repeated tasks; force measurement tests will be performed with the aid of a dedicated platform.

International Conference on Medical Robots 2012 (RobMed2012), Zabrze, Poland

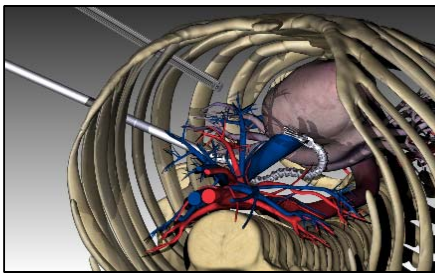


Figure 22: Minimal invasive surgery

The 10th Conference on Medical Robots, organized by the International Society for Medical Robotics, was held on December 7th, 2012 in Zabrze, Poland. STIFF-FLOP members took the chance to take part in the conference as it was on the day after the STIFF-FLOP workshop at FRK. In response to a broad interest among representatives of science, medicine and the media, the conference presentations and hands-on activities focussed on a wide range of robotized equipment used in medicine. After the revival of medical robotics in Poland -to a large extent due to the Robin Heart Project- the International "Medical Robots 2012" could show the enormous progress of robot-assisted surgery that has been accomplished over the last decade, in Poland and internationally. The conference showcased work of the Robin Heart Project and others Polish robot projects (for instance rehabilitation robots). Key international speakers, including Kaspar Althoefer, Richard Satava and Mehran Anvari, provided a comprehensive overview of the activities and advances in robot surgery and provided their respective viewpoints, initiating discussions on the future of robotics in the area of surgery and medicine.

The competition for young participants of the conference was addressed to students and young researchers. Award prizes for the most talented young scientists - Robin Statue and Audience Award - Robin Arrow were given to Radosław Nowosielski, a student from Wroclaw University of Technology who presented his work on "Surgical telemanipulator control platform". More information about the conference can be found on www.medicalrobots.eu and in the first issue of Medical Robotics Reports (www.medicalroboticsreports.com).

Overall, the conference was well received.

Announcements and Upcoming Events

STIFF-FLOP Review Meeting at IIT, Genova, Italy

The first STIFF-FLOP review meeting will take place on 9th and 10th April 2013 at IIT in Genova, Italy. For further information please refer to the STIFF-FLOP Webpage: www.STIFF-FLOP.eu .

Lab visit at University of Torino

The team of the University of Torino invited the partners of the STIFF-FLOP team to a lab-tour on 11th April 2013. For further information please refer to the STIFF-FLOP Webpage: www.STIFF-FLOP.eu .

Publications and Press

Conference Contributions:

Event:	**Keynote Speech by Prof. Althoefer at the 20th International Congress of the European Association for Endoscopic Surgery (EAES), Brussels, Belgium**
Title:	Tools and Devices for Present and Future Surgery - New Generations of Endoscopes
Date:	June 20-23, 2012

Event:	**Keynote Sir Alfred Cuschieri Lecture at the 20th International Congress of the European Association for Endoscopic Surgery (EAES), Brussels, Belgium**
Title:	The flexible endoscope as a surgical tool*, Prof. Alberto Arezzo*
Date:	June 20-23, 2012

Event:	**Olympus Single Port Surgery Prize, by Arezzo A, Scozzari G, Famiglietti F, Passera R, Morino M at the 20th International Congress of the European Association for Endoscopic Surgery (EAES), Brussels, Belgium**
Title:	Is Single Port Laparoscopic Cholecystectomy safe? Results of a Systematic Review and Meta-Analysis
Date:	June 20-23, 2012

Event:	**Hamlyn Symposium 2012, Imperial Royal Geographical Society, London, UK**
Title:	2DOF MR-Compatible Cardiac Catheter Steering Mechanism, *Ali Ataollahi*
Date:	July 1-3, 2012

Event:	**Keynote Speech at ReMAR 2012, Tianjin, China**
Title:	MR Compatible Optical Multi-Axis Force/Torque Sensors for Robotic Surgery based on Parallel Mechanisms, *Prof. Kaspar Althoefer*
Date:	July 9-11, 2012

Event:	**B. Hochner, Invited speaker in a symposium on: "Invertebrate models for locomotion research". at the International Congress of Neuroethology, August 5-10, 2012 College Park, MD. USA**
Title:	The neurophysiological basis of motor function in the octopus - an animal with an unusual 'embodiment'
Date:	August 5-10, 2012

Event:	**2012 IEEE International Conference on Multisensor Fusion and Information Integration, Hamburg, Germany**
Title:	An Optical Multi-Axial Force/Torque Sensor for Dexterous Grasping and Manipulation *Ramon Sargeant, Hongbin Liu, Lakmal Seneviratne, Kaspar Althoefer*
Date:	September 13-15, 2012

Event: **SMIT 2012, Society for Medical Innovation & Technology, Barcelona, Spain**
Title: Which Treatment for Large Rectal Adenomas? Transanal Endoscopic Microsurgery or Endoscopic Submucosal Dissection? Results of a Systematic Review and Meta-Regression, *Prof. Alberto Arezzo*
Date: September 21, 2012

Event: **Robotics Session, 2nd International Oncological Engineering Conference, Leeds, UK**
Title: Intelligent Robotic Tools and Devices for MIS: Present and Future**,** *Prof. Kaspar Althoefer*
Date: September 17, 2012

Event: **CoRe Show and Tell, King's College London**
Date: October 5, 2012
News: Prof. Kaspar Althoefer, Dr Thrishantha Nanayakkara, and several RAs and PhD students from the Centre for Robotics Research, Department of Informatics, King's College London presented current projects and progress, with an emphasis on the STIFF-FLOP project. The Show and Tell was open to all of King's College London staff and students.

Event: **EURONOTES 2012, Prague**
Title: Working group on Appendectomy & Cholecystectomy**,** *Prof. Alberto Arezzo*
Date: October 5, 2012

Event: **Accepted Paper at IROS 2012, Faro, Portugal**
Title: Design of a Variable Stiffness Flexible Manipulator with Composite Granular Jamming and Membrane Coupling
Allen Jiang, Georgios Xynogalas, Prokar Dasgupta, Kaspar Althoefer, Thrish Nanayakkara
Date: October 9, 2012

Event: **B. Hochner, Special Invited Guest Speaker in the 2012 Karger Workshop on "The Evolution of Brain Complexity and Animal Awareness" at the J.B Johnston Club Annual Meeting, New Orleans, USA**
Title: The brain/body/behavior organization in an animal with an unusual morphology - an 'embodied' view on the organization of the nervous system of Octopus vulgaris
Date: October 11, 2012

Event: **B. Hochner, Invited Guest Speaker in the 2012 J.B Johnston Club Annual Meeting, New Orleans, USA**
Title: Conservation, convergence and variability in the neurophysiological organization of a learning and memory system in advanced molluscan cephalopods – octopus and cuttlefish
Date: October 12, 2012

Event: **Keynote Lecture at the Italian Society for Colorectal Surgery, Sanremo, Italy**
Title: Difficult colorectal polyps*, Prof. Alberto Arezzo*
Date: November 10, 2012

Event: **Update in Coloproctology 2012, Vercelli, Italy**
Title: EMR & ESD, NOTES & SILS**,** *Prof. Alberto Arezzo*
Date: December 10, 2012

Event: **Advances in Intestinal and Colorectal Surgery, Naples, Italy**
Title: Transanal Endoscopic Microsurgery**,** *Prof. Alberto Arezzo*
Date: December 13, 2012

Event: **Accepted Paper at ESA 2013 (European Surgical Association), Beaune, France**
Title: Systematic Review and Meta-Analysis of Endoscopic Submucosal Dissection versus Transanal Endoscopic Microsurgery for Non-invasive Large Rectal Lesions, *Arezzo A, Passera R, Saito Y, Sakamoto T, Kobayashi N, Sakamoto N, Yoshida N, Naito Y, Fujishiro M, Niimi K, Ohya TR, Ohata K, Okamura S, Iizuka S, Takeuchi Y, Uedo N, Fusaroli P, Bonino MA, Verra M, Morino M*
Date: April 12-13, 2013

Meetings' Abstracts:

Michael Kuba, Tamar Gutnick, Binyamin Hochner. Meeting an alien – Behavioral experiments on the octopus. International Congress of Neuroethology 5-10 August 2012 College Park, MD, USA.

T. Gutnick, K. E. Thonhauser, B. Hochner and M. J. Kuba. Octopus vulgaris uses arm positional information to direct its arm in a two-ways choice maze . Program No. 294.14. 2012 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2012. Online.

J. Richter, M. Kuba, B. Hochner. Adaptation of reaching and fetching movements in Octopus vulgaris. 176.11. 2012 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2012. Online.

Journal Papers:

Arezzo A, Passera R, Scozzari G, Verra M, Morino M. **"Laparoscopy for rectal cancer reduces short-term mortality and morbidity. Results of a systematic review and meta-analysis"**. Surg Endosc. 2012 Nov 25 [Epub ahead of print].

Arezzo A, Scozzari G, Famiglietti F, Passera R, Morino M. **"Is Single Port Laparoscopic Cholecystectomy safe? Results of a Systematic Review and Meta-Analysis"**. Accepted by: Surgical Endoscopy, 2012.

Arezzo A, Passera R, Scozzari G, Verra M, Morino M. **"Laparoscopy for extra-peritoneal rectal cancer reduces short-term mortality and morbidity. Results of a systematic review and meta-analysis"**. Accepted by: UEG Journal, 2012.

A Arezzo, C Zornig, H Mofid, KH Fuchs, W Breithaupt, J Noguera, G Kaehler, R Magdeburg, S Perretta, B Dallemagne, J Marescaux, C Copaescu, F Graur, A Szasz, A Forgione, R Pugliese, G Buess, H Bhattacharjee, G Navarra, M Godina, K Shishin, M Morino. **The EuroNotes Clinical Registry for Natural Orifice Translumenal Endoscopic Surgery. A 2 years activity report.** Submitted to: Surgical Endoscopy, 2012.

Hochner B **"An Embodied View of Octopus Neurobiology"**. (2012) Current Biology : 22:R887-R892.

Feinstein N, Nesher N, Hochner B (2011) **"Functional morphology of the neuromuscular system of the Octopus vulgaris arm"**. Vie et Milieu – Life and Environment 61:219-229.

Advisory Groups

A number of advisory groups were set up and colleagues from different scientific backgrounds agreed to be members of these groups and provide advice to the project where required.

Special Interest Group

- Prof. Andreas Melzer, University of Dundee, UK
- Dr. Irion, Dr. Solleder, Dr. Nowatschin, Karl Storz, Germany
- Dr. Shamim Khan, Guy's Hospital London, UK

Peer Review Board

- Prof. Elena De Momi, Politecnico di Milano, Italy and Co-Investigator of EuRoSurge
- Prof K. Schilling, University of Wuerzburg (to be confirmed)

EAES Task Force

- Prof. Alberto Arezzo and Prof. Mario Morino, Digestive, Colorectal, Oncologic and Minimal Invasive Surgery, Department of Surgery, University of Torino, Italy
- Prof. Andreas Melzer, IMSAT Institute, University of Dundee, UK
- Prof. Yoav Mintz, Director of Center for Innovative Surgery, Hadassah-Hebrew University Medical Center, Jerusalem, Israel
- Prof. Carsten N. Gutt, Department of Surgery, Klinikum Memmingen, Germany
- Prof. Georg Kaehler, Klinikum Mannheim Chirurgische Klinik, Germany

The TASK FORCE for continuous clinical feedback and consultancy was established and the STIFF-FLOP project was presented officially to all members during the 2012 EAES annual meeting (in Brussels, 20-23 June 2012)