Ali Hassan-Zahraee, Assistant Professor of Medical Robotics
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EDUCATION

2012   Ph.D. Medical Robotics, Sorbonne Université, Paris, France
Dissertation: «Dexterous Serial Comanipulation for Minimally Invasive Surgery», Advisor: Prof. Jérôme Szewczyk

2007   M.Sc. Electrical Engineering, Ecole Nat. Sup. d'Electronique et de ses Applications, Cergy, France
Dissertation: «Reliability of RoHS Electronics in Harsh Environments», Advisor: Prof. Mohammed Djemai

2005   B.S. Electrical Engineering, Isfahan University of Technology, Iran

WORK & RESEARCH EXPERIENCE

07.2019 – present   **Assistant Professor of Medical Robotics, Isfahan University of Medical Sciences, Iran**
Teaching   Medical Robotics, Engineering Mathematics, Medical Instrumentation
Research   Telesurgery, Medical Device Design

10.2016 – 07.2019
(~3 year)   **R&D Manager, Masstec Medical, Isfahan, Iran**

Directing R&D activities on medical catheters, biopsy needles, and surgical instruments

08.2015 – 09.2016
(1 year)   **Postdoc researcher, The University of Sheffield, UK**

Project   Assessing the Underworld (ATU)
Funding   Engineering and Physical Sciences Research Council (EPSRC)
Tasks   Design and development of a small pipe inspection robot
- Preparing design requirements with industry experts
- Mechanical design of the robot prototype with new mechanism design
- Electronic design of the robot controller
- Firmware development for the robot controller
- Test in water

10.2014 – 09.2015
(1 year)   **Research engineer, Interactive Robotic Lab, Commissariat à l'Energie Atomique, France**

Project   ADN4SE
Funding   Agence Nationale de la Recherche
Tasks   Developing a real-time Linux based embedded controller for a 6-DOF industrial robotic arm (Alfred arm)
- Developing control and communication modules for the robotic arm
- Developing Linux drivers for real-time communication over Ethercat
- Porting existing code from VxWorks to Linux RT
- Cross-compilation and implementation on ARM
- Testing and debugging code on the robotic arm

02.2013 – 12.2013
(11 months)   **Postdoc researcher, Institut d'Electronique Fondamentale, Université Paris-Sud, France**

Project   SPY
Funding   ITEA2 (European Union)
Tasks   Algorithm-Architecture Matching for high throughput computation on embedded processors
- Porting algorithms (developed in C on x86) to SIMD NEON for ARM
  . High level algorithmic transforms (loop unrolling, SOA to AOS transforms)
  . Parallel programming (OpenMP) and comparison with SIMD
- Development in Linux, cross compilation for ARM (ARMCC & GCC)
- Embedded Linux kernel compilation (Linaro, Buildroot), and development of a kernel module (for programming performance registers) on ARM targets (Cortex-A8, A9 & A15)
- Code verification and on-target debugging (GDB)
- On-Target code profiling (inline counters)

02.2012 - 01.2013 (1 years)	**Research engineer, Elveflow, Paris, France**

Tasks Development of measurement and control instruments (pressure, flow and temperature controllers) for microfluidic applications
- Electronic design (schematic and layout with Altium), prototyping and test of data acquisition and control boards
- Firmware development (C in Linux) for microcontrollers (Atmel)
- Hands-on test and debugging of electronics and firmware

04.2011 - 10.2011 (7 months)	**Research Assistant, Ecole Normale Supérieur Paris, France**

Project BioCell
Funding C'Nano Center of Excellence in Nanosciences
Tasks Development of a temperature controlling system for biological microscopy
- Electronic design (schematic and layout with Altium), prototyping and test of data acquisition and control boards
- Firmware development (C in Linux) for microcontrollers (Atmel)
- Hands-on test and debugging of electronics and firmware

10.2007 - 12.2010 (3.5 years)	**Research Assistant, Institut des Systèmes Intelligents & Robotique, UPMC**

Project ID2U
Funding Agence Nationale de la Recherche
Tasks Study and development of a hand-held robotic instrument for laparoscopy
- Development of a surgical simulator for minimally invasive surgery (C, OpenGL)
- Electronic design and development of the robot controller, with the sensor based control algorithm implemented on microcontroller, and a power electronic circuit for the actuators
- Mechanical design of the robot's mechanisms (SolidWorks, rapid prototyping)
- Test and validation of the robot on porcine model with surgeons in operating room
- Patented design (FR2961682 & US20130172860)

4.2007 - 09.2007 (6 months)	**Engineering Intern, Schlumberger, Oslo, Norway**

Tasks Reliability study of RoHS electronics in harsh environments
- Accelerated temperature testing of RoHS electronic boards
- Non-destructive analysis of tested boards (SEM & SAM) to detect their weak points in harsh environments (very low or very high temperatures)
- Suggesting design modifications based on the results of the analysis to limit risk of failure and improve reliability

06.2006 - 08.2006 (2 months)	**Engineering Intern, Illinois Institute of Technology, Chicago, USA**

Tasks Simulation of a high power battery charger circuit for hybrid vehicle applications in Simulink
- Simulink modeling based on the schematics
- Determining optimal simulation parameters to obtain best compromise between precision and simulation speed
- Suggesting components to update the circuit based on the simulation results

TEACHING EXPERIENCE

2019 – 2020	**Isfahan University of Medical Sciences, Iran**
	Masters and Ph.D level: Medical Robotics, Engineering Mathematics, Medical Instrumentation
2013 – 2014 (37 H)	**Part-time lecturer, ESME Sudria, Paris, France** Analog Electronics lab, undergraduate level
2013 – 2014 (24 H)	**Part-time lecturer, University of Paris-Sud, France** Introduction to Robotics, graduate level
2007 – 2010 (64 H / year)	**Teaching Assistant, University of Paris-Est, France** Analog Electronics Lab, undergraduate level

SKILLS

Embedded Software Development
C, C++, Matlab, Bash, Real-time, Parallel Programming, SIMD, GNU Compiler & Tools, CMake, GIT. Eclipse
ARM processors (Raspberry Pi, Beaglebone, etc.), Microcontrollers (Atmel, Arduino), Embedded Linux

Electronics
Amplifiers, Filters, Oscillators, Sensors, ADC & DAC, Data Acquisition, Mixed Signal Circuit Design, CAD and Simulation (Altium, Eagle, Orcad)

Mechanics
CAD (SolidWorks), Rapid prototyping, Machining

Languages
Bilingual French/Persian, Fluent in English (TOEFL IBT 108)

PUBLICATIONS

Patents

1. Hassan Zahraee, A.; Szewczyk, J. « Surgical Instrument in Particular for Peritoneal Surgery », US20130172860.
2. Hassan Zahraee, A.; Szewczyk, J. « Instrument chirurgical notamment pour chirurgie péritonéale », FR2961682.
3. Hassan Zahraee, A.; Szewczyk, J. « Instrument chirurgical notamment pour chirurgie péritonéale », WO2012001026.
4. Mampeta, A.; Hassan Zahraee, A.; Fox, S.; « Surgical Instrument », GB1300165.6.

Journal Articles

1. Romero A, Lacassagne L, Gouiffès M, Zahraee AH. Covariance tracking: architecture optimizations for embedded systems. EURASIP Journal on Advances in Signal Processing. 2014;2014(1).
2. Herman B, Devreker A, Richer F, Zahraee AH, Szewczyk J. An articulated handle to improve the ergonomic performance of robotic dextrous instruments for laparoscopic surgery. Mechanical Sciences. 2014;5(1):21–8.
3. Menudet J-F, Zarhaee A, Solano B, Szewczyk J, Herman B, Rotinat C, et al. ID2U Project: Single use dexterous surgical instrument. IRBM. 2011;32(3):169–71.
4. Zahraee AH, Paik JK, Szewczyk J, Morel G. Toward the Development of a Hand-Held Surgical Robot for Laparoscopy. IEEE/ASME Transactions on Mechatronics. 2010;

Conference Proceedings

1. Ma K, Schirru MM, Zahraee AH, Dwyer-Joyce R, Boxall J, Dodd TJ, et al. Robot mapping and localisation in metal water pipes using hydrophone induced vibration and map alignment by dynamic time warping. 2017 IEEE International Conference on Robotics and Automation (ICRA). 2017;
2. Ma K, Schirru M, Zahraee AH, Dwyer-Joyce R, Boxall J, Dodd TJ, et al. PipeSLAM: Simultaneous localisation and mapping in feature sparse water pipes using the Rao-Blackwellised particle filter. 2017 IEEE International Conference on Advanced Intelligent Mechatronics (AIM). 2017;
3. Ma K, Zahraee AH, Zhu J, Mills R, Boxall J, Dwyer-Joyce R, Dodd TJ, et al. Robotic Mapping and Localisation in Feature Sparse Water Pipes. 2016 World Conference on Non-Destructive Testing (WCNDT). 2016;
4. Lacassagne L, Etiemble D, Zahraee AH, Dominguez A, Vezolle P. High level transforms for SIMD and low-level computer vision algorithms. Proceedings of the 2014 Workshop on Workshop on programming models for SIMD/Vector processing - WPMVP 14. 2014;
5. Romero AM, Lacassagne L, Zahraee AH, Gouiffès M.. Real-time covariance tracking algorithm for embedded systems. 2013 Conference on Design & Architectures for Signal & Image Processing (DASIP). 2013;
6. Herman B, Devreker A, Richer F, Zahraee AH, Szewczyk J. An Articulated Handle to Improve the Ergonomic Performance of Robotic Dextrous Instruments for Laparoscopic Surgery. 2013 Design of Medical Devices Conference - Europe (DMD). 2013;
7. Herman B, Zahraee AH, Szewczyk J, Morel G, Bourdin C, Vercher J-L, et al. Ergonomic and gesture performance of robotized instruments for laparoscopic surgery. 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2011;
8. Zahraee AH, Herman B, Szewczyk J. Mechatronic design of a hand-held instrument with active trocar for laparoscopy. 2011 IEEE International Conference on Robotics and Automation (ICRA). 2011;
9. Zahraee AH, Szewczyk J, Paik JK, Morel G. Robotic Hand-Held Surgical Device: Evaluation of End-Effector's Kinematics and Development of Proof-of-Concept Prototypes. Medical Image Computing and Computer-Assisted Intervention (MICCAI). 2010 Lecture Notes in Computer Science. 2010;:432–9.
10. Zahraee AH, Szewczyk J, Morel G. Simulation for Optimal Design of Hand-Held Surgical Robots. 2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society. 2009;
11. Zahraee AH, Szewczyk J, Morel G. Evaluating control modes for hand-held robotic surgical instrument using virtual reality simulator. 2009 IEEE/ASME International Conference on Advanced Intelligent Mechatronics. 2009;
12. Benmansour K, Zahraee AH, Djemai M. Hybrid Modelling of a Multicellular Converter. Proceedings of the 41st International Universities Power Engineering Conference. 2006;