David FOLIO

2018-02-19

Biomedical MicroRobotics

HDR thesis

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CHAPTER I

CONTEXT OF ACTIVITIES

This chapter introduces the various activities that I have conducted since as I have started being involved as researcher-teacher. It first starts with an overall overview of my career, that sets the background in which my works was carried out. This global view contains several issues, which are synthesized, in order to explain the general structuring of my activities.Actually, as in any faculty position, my works encompass several activities, that are mainly related to teaching and research. The organization of these tasks are then presented in section **I**.2. This integrates the articulations of the teaching, research, supervisions and collaboratives works in a general framework synergy. This chapter largely refers to the appendices **A** and **B**, that include a long version of my resume, and the list of my publications respectively.

I.1 CAREER OVERVIEW

I.1.1 Doctorate degree and post-doctorate

I have defended my Ph. D. in Robotics in 2007 within the Robotics, Action, and Perception (RAP) group of the Laboratory for Analysis and Architecture of Systems[1] (LAAS), CNRS[2], under the supervision of Viviane Cadenat, Associate Professor at Paul Sabatier University of Toulouse, France. My Ph. D. thesis dealt with the design of multi-sensor based control strategies allowing a mobile robot to perform vision-based tasks amidst possibly occluding obstacles. We have first proposed techniques able to fulfill simultaneously the mentioned objectives. However, avoiding both collisions and occlusions often over-strained the robotic navigation task, reducing the range of realizable missions. This is the reason why we have developed a second approach which lets the visual features loss occurs if it is necessary for the task realization. Using the link between vision and motion, we have proposed different methods (analytical and numerical) to compute the visual signal as soon it becomes unavailable. We have then applied them to perform vision-based tasks in cluttered environments, before highlighting their interest to deal with a camera failure during the mission.

In addition, during my doctorate degree, I also had the opportunity to perform teaching activities, first as temporary teacher (3 years), and then as teaching assistant, specifically in French "*Attaché Temporaire d'Enseignement et de Recherche*" (ATER, 1 year) both for the

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[1]LAAS: `http://www.laas.fr`
[2]French National Center for Scientific Research. `http://www.cnrs.fr`

Paul Sabatier University of Toulouse. These global teaching experiences have led to a total volume of 308 hETD[3].

Between 2007 and 2008, I joined the Lagadic team at Inria Rennes-Bretagne Atlantique[4] as a postdoctoral fellow on sensory control for unmanned aerial vehicles. My postdoctoral fellow has been supported by Sensory Control for Unmanned Aerial Vehicles (SCUAV) ANR[5] project. The main objective was to improve multi-sensor-based servoing tasks for unmanned aerial vehicles. The idea was to design robust control law that combine different sensory data directly at the control level. Especially, I have contributed to the design of a new on-line sensor self-calibration based on the sensor/robot interaction links [ACT2].

I.1.2 Tenured as Associate Professor

In 2008, I was recruited as Associate Professor at *École Nationale Supérieur d'Ingénieurs* (ENSI) of Bourges, which is now the *Institut National des Sciences Appliquée* (INSA) Centre Val de Loire[6]. Since my tenure, I have been regularly involved in the life of the institute. In particular, I contribute at a local level to the scientific animations (*e.g.*, organization of laboratory visits), transfer and training-research links. Thus, I regularly attend the international relations division by accompanying, among others, the different delegations of schools and universities partners during their visits to INSA Centre Val de Loire. In March 2017, the direction of the INSA Centre Val de Loire given to me the mission of referent "*racism and antisemitism*". Figure I.1 shows the relevant events related with my activities since tenured as Associate Professor.

As senior lecturer, I am mainly involved in the development of electronics and electrical sciences teaching activities of the institute. In particular, I have contributed to develop all of the teaching materials for the electronics and electrical sciences courses and tutorials. Since tenured as associate professor, my average teaching loads is about 280 hETD. These activities loads is varied depending on the recruitment and the choice of engineering students in the different departments in which I intervene. Since September 2014, I am in charge of the Nuclear Energy option of the 5th year (engineer's degree, M2) of the Industrial Risk Control (MRI[7]) department. In November 2017, I have been elected as member of the council department of the Energy, Risks and Environment (ERE). Further informations on my teaching activities and responsibilities are provided in appendix A.2.

Furthermore, I perform my research activities with the PRISME[8] Laboratory in the Robotics team of the Images, Robotics, Automatic control and Signal (IRAuS) unit. Since I am an Asso-

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[3]Equivalent TD hours, in French "*heures équivalentes TD*" (hETD) is the reference hour to calculate the teaching duties. The rules are as follows: 1 h of course = 1.5 hETD, while the others, *e.g.*, 1 h of tutorial (TD) = 1 h of practical work (TP) = 1 hETD.

[4]French Institute for Research in Computer Science and Automation (French: *Institut national de recherche en informatique et en automatique*). https://www.inria.fr/centre/rennes

[5]*Agence Nationale de la Recherche* (ANR) is the French National Agency for Research. http://www.agence-nationale-recherche.fr

[6]INSA Centre Val de Loire (INSA CVL) was created in 2014 by the merge of *École Nationale d'Ingénieurs du Val de Loire* (ENIVL) of Blois and ENSI of Bourges. In 2015, the *École Nationale Supérieure de la Nature et du Paysage* (ENSNP) of Blois is integrated to INSA Centre Val de Loire. http://www.insa-centrevaldeloire.fr

[7]In French *Maîtrise des Risques Industriels (MRI)*

[8]*Laboratoire Pluridisciplinaire de Recherche en Ingénierie des Systèmes, Mécanique, Énergétique* (PRISME) Laboratory is from University of Orléans and INSA Centre Val de Loire (EPRES 4229). http://www.univ-orleans.fr/PRISME.
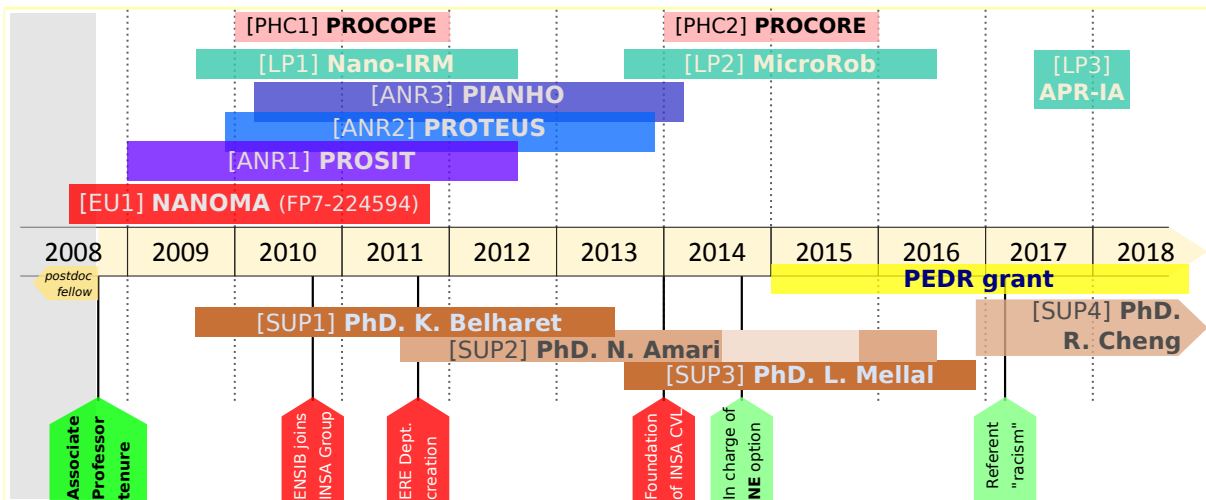
Figure I.1 – Progress of main events and activities (*e.g.* projects and supervisions) since tenure. For further informations on the different project, and the Ph. D. supervisions refer to appendices **A**.3.1 and **A**.3.2 respectively.
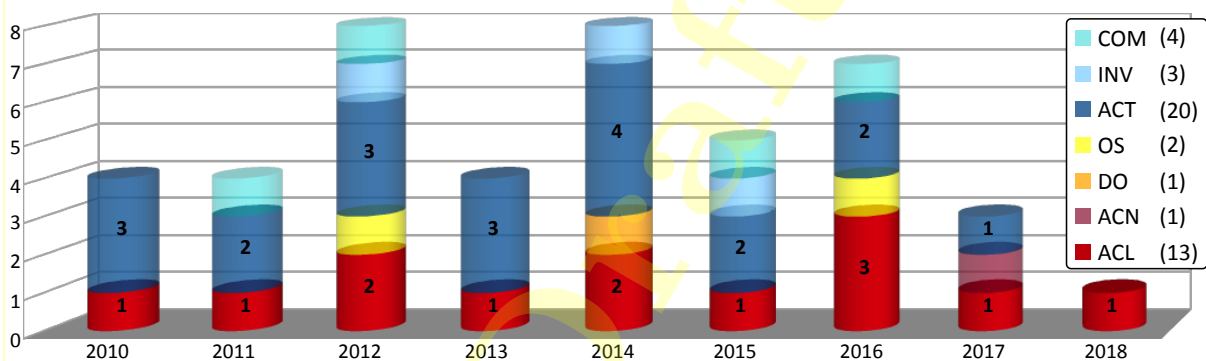

Figure I.2 – Personal references timeline evolution since tenured as Associate Professor. The listed publications follows the nomenclature proposed by the "*Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur*" (Hcéres) [1]. The detailed list of my publications and the nomenclature are given in appendix **B**.

ciate Professor, my research interests mainly deal with the modeling and control for nano and micro-robotics in a biomedical context. It can be noticed that I had to apply a slight change of my research topics to address the specificities of the microworld. Actually, in a first time, my research activities have been mainly related with the European project NANOMA[9]. This project consisted to design microrobotic system for targeted drug delivery through the cardiovascular system. Parallelly, I have also contributed to the development of micromanipulation activities of the laboratory. Firstly, the micromanipulation has been devoted for intra-cytoplasmic applications [ACT4, ACL4]. Next, this research activities evolved to object micromanipulation to be placed in the focus of a light beam within the ANR project PIANHO[10] [ANR3]. The different projects in which I have been involved are reported in the Figure **I**.1, and detailed in appendix **A**.3.1. In addition, I have directly co-supervised the works of 4 Ph. D. students (with

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[9]Nano-Actuators and Nano-Sensors for Medical Applications (see also [EU1])

[10]Innovative Haptic Instrumental platform for 3D Nano-manipulation

one still on going), with their names also reported in the Figure **I**.1. I also had the opportunity to follow the research works of 5 external Ph. D. students. Further informations about these supervisions are given in the appendix **A**.3.2.

Since tenured in 2008, these various scientific activities have led, to 43 publications, including[11] 13 articles (ACL), 1 guest editorial (DO), 2 books chapter (OS) and 20 proceedings (ACT). Figure **I**.2 illustrates the timeline progress of my publishing activities and the detailed list of my publications are given in appendix **B**. As of 2018, I had an H-index of 12 based on Google Scholar Citations[12].

I.2 ACTIVITIES ORGANIZATION

I.2.1 Research Context

I.2.2 Scientific Topics

I.2.2.1 subsub section

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subparagraph

I.3 MANUSCRIPT OVERVIEW

I.3.1 sub section

I.3.2 sub section

I.3.3 sub section

I.3.4 sub section

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[11]The bibliography categories follow the nomenclature proposed by the "*Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur*" (Hcéres) [1]. Hcéres stand for the High Council for Evaluation of Research and Higher Education, and it is an independent administrative authority. `http://www.hceres.fr`

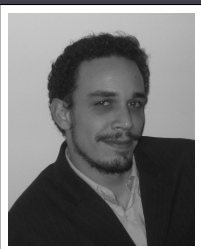[12]See also my Google Scholar profile: `http://scholar.google.com/citations?user=XQVc6JMAAAAJ`

CHAPTER II

CHAPTER 2

APPENDICES

DAVID FOLIO

Born on the 17th September 1979, French nationality

Associate Professor (tenured)

*Robotic and Micro/Nano-robotic
for biomedical and health-care applications*

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A.1 CURRICULUM VITÆ

A.1.1 Current position and responsibilities

Since 2008   Associate Professor *(maître de conférences, 61$^{\text{ème}}$ CNU section)*

INSA Centre Val de Loire, Université d'Orléans, PRISME Laboratory EA 4229 Bourges, France

Teaching member of the teaching team of the Industrial Risk Control (MRI[1]), of the Energy, Risks, and Environment (ERE), and of the Sciences and Techniques for Engineers (STPI[2]) departments;

Research member of the Robotic team of the IRAuS unit of PRISME Laboratory

Since 2014   in charge of the Nuclear Energy option of the 5$^{\text{th}}$ year (engineer's degree) of the Industrial Risk Control (MRI) department.

Since 2017   referent of "*racism and antisemitism*".

Since 2017   elected member of the Energy, Risks and Environment (ERE) department council.

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[1]In French *Maîtrise des Risques Industriels (MRI)*.
[2]In French *Science et Technique pour l'Ingénieur (STPI)*.

A.1.2   Experience and Graduate Education

Oct. 2007 Aug. 2008	**Post-Doctorate** at Inria de Rennes Bretagne Atlantique[3], Rennes, France Research conducted in Lagadic team, supervised by François Chaumette.
Feb. 2007 Aug. 2007	**Teaching assistant:** *Attaché Temporaire d'Enseignement et de Recherche (ATER)* at Paul Sabatier University of Toulouse, France
Feb. 2004 Jul. 2007	**Doctorate** at LAAS-CNRS, Toulouse, France Ph.D. Thesis in Robotic control, directed by Viviane Cadenat, entitled "*Multi-sensor-based control strategies and visual signal loss management for mobile robots navigation*".
2003–2004	**Master of Science** *(DESS)* Intelligent Systems at Paul Sabatier University of Toulouse, France
2002–2003	**Master of Advanced Studies** *(DEA)* Computer Sciences at Paul Sabatier University of Toulouse, France
1999–2002	**Scholarship** *(IUP[4], L2-M1)* on Intelligent Systems at Paul Sabatier University of Toulouse, France
1997–1999	**Bachelor's degree** *(DEUG, L1-L2)* in Science and Technology for the Engineer, at University of Reunion Island, France

A.1.3   Professional Activities

Since 2015	Member of the program committee of the *International Conference on Robotics, Manipulation, and Automation at Small Scales* (MARSS)
Since 2013	Editorial Board member of the *International Journal of Advanced Robotic Systems* (IJARS).
Since 2005	IEEE member (SM'05, AM'08, M'12)
Regular Reviewer	• *IEEE Transactions on Robotics* (TRO); • *IEEE Transactions on Biomedical Engineering* (TBME); • *IEEE/ASME Transactions on Mechatronics* (TMECH); • *IEEE Transactions on Automation Science and Engineering* (TASE); • *International Journal of Advanced Robotic Systems* (IJARS); • *IEEE International Conference on Robotics and Automation* (ICRA); • *IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS); • *IEEE International Conference on Biomedical Robotics and Biomechatronics* (BioRob);
Awards	French outstanding research award (PEDR 2014-2018)

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[3]French Institute for Research in Computer Science and Automation (French: *Institut national de recherche en informatique et en automatique*). `https://www.inria.fr/centre/rennes`

[4]In French *Institut Universitaire Professionnalisé* (IUP)

A.2 TEACHING ACTIVITIES

A.2.1 Teaching

My overall teaching activities have been solely related with the 61[5]st CNU section which regroups scientific disciplines from control, computer engineering and signal processing. I taught these teaching as a temporary teacher (3 years), teaching assistant (ATER, 1 year), and then as associate professor (10 years). These different experiences are presented in the following.

A.2.1.1 Before tenure

I have started teaching as a temporary teacher at the Paul Sabatier University of Toulouse, France, during my doctorate (2004-2006). Next, I have pursued as teaching assistant, specifically in French "*Attaché Temporaire d'Enseignement et de Recherche*" (ATER, 2007) for the Paul Sabatier University of Toulouse. My teachings were then mainly in the fields of robotics, control theory, image processing and real-time systems for students from bachelor's to master's degrees. These global teaching experiences have led to a total volume of 308 hETD[6].

These activities were my first experience in high-graduate education. Those opportunities highlighted my interest in the scientifics knowledge transmission. They also allowed me to be familiarized with the different forms of teachings. Indeed, I had then the opportunity to supervise not only tutorials (TD), practical work (TP), and long-term projects (BE); but also few courses. Especially, I also helped the teaching team by writing some TP contents, and in the students evaluation. This first experience confirmed my interest in teaching, leading me logically to apply for an associate professor position.

A.2.1.2 Since tenured

I was recruited as Associate Professor in September 2008 for the 61st CNU[5] section. Untill now, my teaching activities have been mainly held at *Institut National des Sciences Appliquée (INSA) Centre Val de Loire* on the Bourges campus. The INSA Centre Val de Loire was established in 2014 following the merger of the Val de Loire ENI (National Engineering School) and Bourges ENSI (Graduate Engineering School). With 200 members of staff (teachers, research professors, administrative and technical staff) the Institute trains 1500 students on its two campuses in Blois and Bourges, France. The Institute awards four engineering degrees:

1. Industrial Risk Control (MRI) in Bourges;
2. Information Technology and Cybersecurity (STI) in Bourges;
3. Energy, Risk and the Environment (ERE) together with the Cher Chamber of Commerce and Industry (CCI) Hubert Curien CFSA (Apprentice Further Training Centre) in Bourges;
4. Industrial Systems Engineering (GSI) in Blois

The Institute was extended in 2015 when it absorbed the National Graduate School for Nature and Landscape, which has now become the "School for Nature and Landscape" department. Like all of the INSA engineering schools, the first two years, that are common to each engineering degrees, is embedded in the Sciences and Techniques for Engineers (STPI) department. It can been noticed, that the ERE department trains engineers through apprenticeship training This program is based on a partnership between the INSA Centre Val de Loire and Hubert Curien CFSA

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[5]*Conseil national des universités* (CNU). http://www.cpcnu.fr

[6]Equivalent TD hours, in French "*heures équivalentes TD*" (hETD) is the reference hour to calculate the teaching duties. The rules are as follows: 1 h of course = 1.5 hETD, while the others, *e.g.*, 1 h of tutorial (TD) = 1 h of practical work (TP) = 1 hETD.

Table A.1 – Overview of the various learned discipline since tenured as associate professor.

Discipline	LMD	Students	Face time				Dept.	Resp.
			C	TD	TP	P/BE		
Electrokinetics	L1	100	18h00	24h00			STPI	Yes
Analogue electronics	L2	80	8h00	32h00			STPI	Yes
	L3	70	10h40	10h40	6h00		MRI	Yes
Electrical engineering	L3	70	10h40	10h40			MRI	Yes
	M1	78	8h00	14h00			ERE	Yes
Control	M1	78	6h00	10h00			ERE	Yes
Signal processing	M1	20	10h40	10h40			MRI	Yes
Diagnostic	M1	20	10h40	10h40			MRI	Yes
Sensors	L3	70		10h40			MRI	No
Robotic	M2	20	4h00				MARS	No
SA project	M1	2				5h20	MRI	No
SI project	M1	10				14h20	MRI	No
Total (face time)			86h40	133h20	6h00	19h40		

LMD The bachelor's, master's, doctorate system (in French *Licence-Master-Doctorat*) designed by the Bologna Process, with
- L1-L3: from the 1ˢᵗ to the 3ʳᵈ year bachelor's degree;
- M1-M2: from the 1ˢᵗ to the 2ⁿᵈ year master's degree;

Students are the average number of students.

C, TD, TP, P refer to face time hours for courses (C), tutorials (TD), practical works (TP), tutored projects (P).

Dept. refers to the department of INSA Centre Val de Loire, that is Sciences and Techniques for Engineers (STPI), Industrial Risk Control (MRI), Energy, Risks and the Environment (ERE).
Further details are available on-line at: `http://www.insa-centrevaldeloire.fr`.

Resp. specifies the case where I am in charge of the discipline, especially with the implementation of the teaching materials.

SA and SI projects refer to the Advanced Systems (SA) advanced module, and the Industrial System (SI) project in the 4ᵗʰ year (M1).

(Apprentice Further Training Centre), which has been an expert in delivering apprenticeship-based training for over 20 years.

   As member of the teaching team on the campus in Bourges of INSA Centre Val de Loire, I am mainly involved in the students formation of the Industrial Risk Control (MRI), of the Energy, Risk and the Environment (ERE), and of the Sciences and Techniques for Engineers (STPI) departments. Specifically, after having started with teaching of electronics and electrical engineering, I have participated or organized lessons on signal processing, sensors, control and robotics. These various teaching experiences imply very different pedagogical tasks. Especially, those tasks are depending on the type of intervention: courses (C), tutorials (TD), practical works (TP), tutored projects (P), long-term project team work (BE); but also according to the different degrees of scientific maturity and specialization of the concerned students, *i.e.* from bachelor's to master's degrees level. Table **A**.1 illustrates a synthetic overview of my different teaching discipline showing the degree, the number of students, and the face-time hours. In particular, I am especially involved in the implementation of the teachings materials, and to support the teaching assistants for the disciplines for which I am in charge.
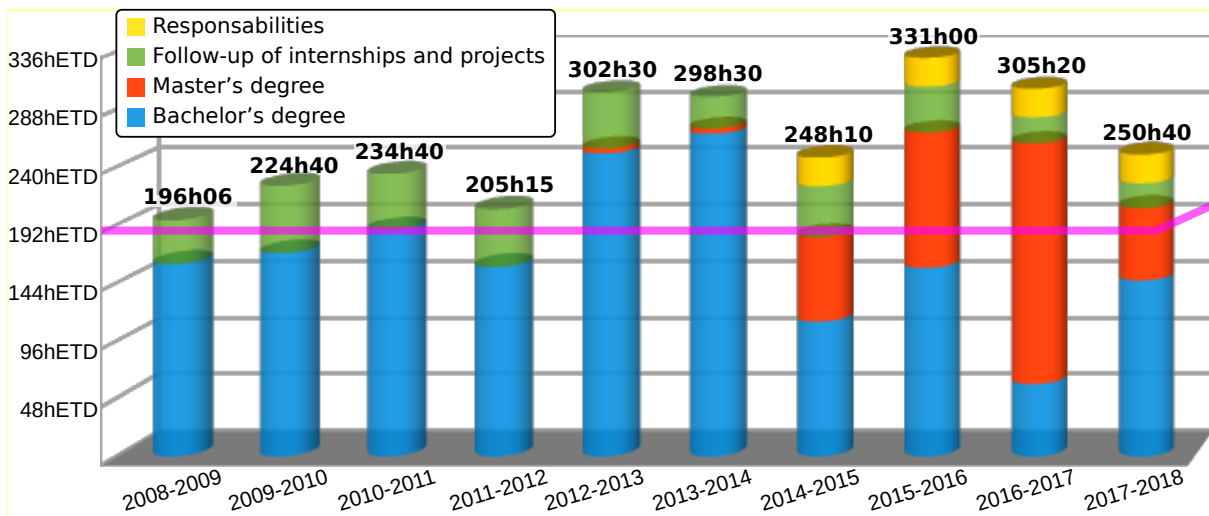
Figure A.1 – Teaching load progress expressed in *"equivalent TD hours"* (see footnote 6). My average teaching load is about 280 hETD. The line at 192 hETD is the minimum teaching duty to be achieved.

Since tenured as associate professor, my average teaching load is about 280 hETD[6]. This activity load is varied depending on the recruitment and the choice of engineering students in the different departments in which I intervene. In particular, the hours performed in tutorials (TD), practical works (TP) or projects (P) depend on the number of groups (*i.e.* from 2 to 4 groups), especially for the bachelor's degrees (L1-L3). Figure **A**.1 presents my teaching duty timeline progress expressed in hETD since tenured as Associate Professor.

Furthermore, some key events in the life of the Institute have also influenced my teaching loads (see also Figure **I**.1). For instance, from 2011, following the integration of the former Bourges ENSI in the INSA group, I took part in the electronics training for the new preparatory cycle. In parallel, since 2011, after the ERE department creation, I have also started to form the apprentices engineers to electrical engineering. In addition, various responsibilities entrusted to me have also influenced my teaching duties, and are presented hereafter.

A.2.2 Responsibilities

In addition to teaching tasks, different obligations are related to the mission of teaching-researchers in France. Thus, I am involved in the life of the Institute. Especially, I contribute at a local level to the scientific animations (eg., organization of laboratory visits), transfer and training-research links. Furthermore, since my tenure, I participate in the juries of our engineering students. Similarly, since our establishment have joint the INSA group, I also contribute to select and interview the applying students (about 15 students/year). Between 2009 and 2013, I have been member of the Hygiene and Security committee of the ENSI of Bourges.

Since September 2014, I am in charge of the Nuclear Energy option of the 5th year (engineer's degree) of the Industrial Risk Control (MRI) department. As such, I coordinate the specific lessons of the option by selecting and recruiting external professional contractors. I also organize visits (power station, simulator, etc.) for the engineering students of the option.

In March 2017, the direction of the INSA Centre Val de Loire given to me the mission of referent *"racism and antisemitism"*. Since November 2017, I am an elected member of the ERE department council.

A.3   RESEARCH ACTIVITIES

A.3.1   Scientific Projects

My research activities regularly lead me to collaborate in various scientific projects. In particular, these projects aim to obtain funds to either recruit Ph. D. students, to design or improve experimental testbeds, as well as to help some scientific cooperations. The different projects in which I have been involved are listed below, specifying my role and the obtained fundings. Let us notice that all of these projects have been subject to a process with a deep scientific review.

A.3.1.1   European Union (EU) and National Funding (ANR) Projects

[EU1] NANOMA: Nano-Actuators and Nano-Sensors for Medical Applications
Date 06/2008 – 10/2011
Funding 3.3 M€, supported by the European Commission
Summary The NANOMA project is an European project funded under FP7 ICT 2007.3.6, Micro/nanosystems, coordinated by Professor Antoine Ferreira, University of Orléans , PRISME Laboratory. The NANOMA project aims at proposing novel controlled nanorobotic delivery systems which will be designed to improve the administration of drugs in the treatment and diagnosis of breast cancer.
Role co-responsible of the workpackage WP4: "Object Tracking, Planning and Control in MRI".

[ANR1] PROSIT: Robotic Platform for an Interactive Tele-echographic System
Date 01/2009 – 09/2012
Funding 230 k€, supported by French national funding (ANR[7])
Summary The PROSIT project is an ANR Contint program (2008) project, coordinated by Professor Pierre Vieyres, University of Orléans , PRISME Laboratory.
The goal is to develop an interactive and complex master-slave robotic platform for a medical diagnosis application (*i.e.*, tele-echography) based on a well defined modular control architecture.
Role co-responsible of the workpackage WP5: "Visual Servoing".

[ANR2] PROTEUS: Robotic Platform to facilitate transfer between Industries and academics
Date 12/2009 – 12/2013
Funding 2.1 M€, supported by French national funding (ANR)
Summary The PROTEUS project is an ANR ARPEGE program (2009) project.
This project motivation was to help organizing interactions between academic and industrial partners of the french robotic community by providing suitable tools and models. Especially, one goal is to create a portal for the French robotic community as embodied by the *GDR Robotique* and its affiliated industrial partners, in order to facilitate transfer of knowledge and problems among this community. To achieve the PROTEUS project 12 partners have been involved.
Role co-responsible of the workpackage: "Young Challenge".

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[7]*Agence Nationale de la Recherche* (ANR) is the French National Agency for Research.   `http://www.agence-nationale-recherche.fr`

[ANR3] PIANHO: Innovative Haptic Instrumental platform for 3D Nano-manipulation
Date 03/2010 – 03/2014
Funding 761 k€, supported by French national funding (ANR)
Summary The PIANHO project is an ANR P3N (2009) project.
The motivation of this project is to create a nanomanipulation platform capable of pick, hold and place nano-objects in the synchrotron radiation beam of the ESRF (Grenoble, France) via tuneable tool-object interaction.
Role co-responsible of the workpackage: "Control of a Two-Fingered AFM-based Nano-manipulation System".

A.3.1.2 Cooperation Projects

[PHC1] PHC PROCOPE: Franco-Germain Hubert Curien[8] partnership
Date 2010 – 2011
Summary Supervision and Control of an Improved Magnetic Resonance Imaging (MRI) Platform for Targeted Administration of Therapeutic Nanorobots.
Partnership Division Microrobotics and Control Engineering (AMiR) (or in German "*Abteilung für Mikrorobotik und Regelungstechnik*") of the University of Oldenburg, Germany, headed by Prof. Dr.-Ing. Sergej Fatikov. http://www.amir.uni-oldenburg.de

[PHC2] PHC PROCORE: France–Hong-Kong Hubert Curien partnership
Date 2014 – 2015
Summary Design, fabrication and characterization of the swim of enhanced helical microrobots.
Partnership Department of Mechanical and Automation Engineering (MAE) of the Chinese University of Hong Kong, with Prof. Li Zhang (). http://www.mae.cuhk.edu.hk

A.3.1.3 Local Project (LP)

[LP1] Nano-IRM
Date 09/2009 – 08/2012
Funding 110 k€, supported by *Région Centre Val de Loire*[9], the Cher (18) departmental councils and the agglomeration comity of Bourges.
Summary Supervision and Control of an Improved MRI Platform for Targeted Administration of Therapeutic Nanorobots. This project supports the above NANOMA project [EU1], by providing the funding for the Ph. D. thesis of Karim Belharet.
Role co-supervision of the Ph. D. thesis of Karim Belharet.

[LP2] MicroRob
Date 10/2013 – 09/2016
Funding 110 k€, supported by *Région Centre Val de Loire* and the agglomeration comity of Bourges.
Summary Modeling and control of magnetic microcarrier for targeted cancer therapy.
Role co-supervision of the Ph. D. thesis of Lyes Mellal.

[LP3] **High Definition Echograph**
Date 03/2017 – 03/2018

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[8]*Partenariats Hubert Curien* (PHC) provides support for international scientific and technological exchange of the Ministry of Foreign Affairs. https://www.campusfrance.org
[9]Administrative region of France for Centre-Loire Valley. http://www.regioncentre-valdeloire.fr

Funding 50 k€, supported by *Région Centre Val de Loire*
Summary Design of novel microrobotic platform with ultrasound probe vision.
Role *Principal Investigator* (PI).

A.3.2 Students Supervisions

My research activities as associate professor led to the supervision of graduate school students from master's to doctoral degrees. Specifically, I had directly supervised 4 doctorate (3 defended theses and 1 on going) and 2 master theses. In addition, I also had the opportunity to follow the research works of 5 external Ph. D. students. The different students that I have supervised or followed their works are listed below.

A.3.2.1 Ph. D. **Students**

Thesis in progress

[SUP1] Ruipeng Cheng,
> **Date** 11/2016
> **Title** Predictive navigation of a magnetic microrobot: instrumentation, control and validation
> **Supervision rate** 50% with the Prof. Antoine Ferreira (INSA Centre Val de Loire)

Defended theses

[SUP2] Karim Belharet,
> **Date** 11/2009 – 10/2013
> **Title** Predictive navigation of a magnetic microrobot: instrumentation, control and validation
> **Supervision rate** 50% with the Prof. Antoine Ferreira (INSA Centre Val de Loire)
> **Publications** [ACT1, ACT3, ACL1, ACL2, OS1, ACT6, ACT8, ACT11, ACL5, ACT13, ACT15]
> **Position** Associate Professor at *École des Hautes Études d'Ingénieur*[10] (HEI).

[SUP3] Nabil Amari,
> **Date** 11/2011 – 08/07/2016
> **Title** Development and Control of a Micro-Robotics Platform for the Synchronization of a Light Beam
> **Supervision rate** 33.3% with the Prof. Antoine Ferreira (INSA Centre Val de Loire)
> **Publications** [ACT9, ACT10, ACT12, ACL6, ACT14, OS2]
> **Position** ???

[SUP4] Lyès Mellal,
> **Date** 11/2013 – 07/12/2016
> **Title** Modeling and Control of Magnetic Microrobots for Therapeutic Targeting
> **Supervision rate** 50% with the Prof. Antoine Ferreira (INSA Centre Val de Loire)
> **Publications** [ACL8, COM3, ACT17, ACT18, COM4, ACT19, ACL11, ACT20]
> **Position**

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[10]French for private School of High Studies in Engineering, `http://centre.hei.fr`.

A.3.2.2 External Students

Hereafter, are mentioned only students follow-ups that has lead to a publication. The mentioned dates correspond to the periods during which the follow-up of the students research was achieved.

[EXT1] Jungsik Kim, Ph. D. degree from Korea Advanced Institute of Science and Technology (KAIST), South Korea.
Date 09/2009–12/2012
Subject A Study of Oocyte/Embryo Manipulation Using Microfluidics and Robotics.
Publications [ACT4, ACL4]
Position Senior Research Engineer at LG Electronics, South Korea

[EXT2] Tao Li, Ph. D. degree from University of Rennes 1, France.
Date 10/2009–02/2013
Subject Control of a tele-echography robot by visual servoing.
Publications [ACL7]
Position Engineer at Total Immersion, Paris.

[EXT3] Christian Dahmen, Ph. D. degree from University of Oldenburg, Germany.
Date 2009–2016
Subject MRI-based dynamic tracking and control of an untethered ferromagnetic micro-robots.
Publications [ACT5, ACT7, ACL10]
Position N/A

[EXT4] Bruno Sarkis, Ph. D. candidate at the Institut Jean Le Rond d'Alembert (IJLRA), UMR 7190, Pierre and Marie Curie University, Paris 6.
Date 11/2014– now
Subject Catalytic microjet modeling
Publications [ACT16, ACL13]

[EXT5] Bumjin Jang, Ph. D. candidate at Multi-Scale Robotics Lab (MSRL) of Swiss Federal Institute of Technology in Zurich[11] (ETH).
Date 11/2016– now
Subject Catalytic locomotion of core-shell nanmotors.
Publications [ACL9]

A.3.2.3 Masters Students

[MS1] Kamel Ncir,
Date 03/2010–08/2010
Subject Modeling and control of a nano-positioning platform
[MS2] Nabil Amari,
Date 03/2011–08/2011
Subject Modeling and control of a nano-positioning platform

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[11]Multi-Scale Robotics Lab (MSRL) is a part of the Institute of Robotics and Intelligent Systems (IRIS), a group of the Swiss Federal Institute of Technology (ETH), Zurich, headed by Prof. Bradley Nelson. `http://www.msrl.ethz.ch`

A.3.3 Scientific Collaborations

My research work have led to various international and national collaborations. These cooperations have made possible to investigate complementary approaches to those I have studied, helping to benefit from supplementary skills. These exchange were interesting and important in view of the strong multi-disciplinarity of the achieved works, the many physical principles used, the many technologies involved or of the scientific scope. Hereafter are listed scientific cooperative works that have led to publications.

[COL1] Nano-IRM

A.3.4 Scientific Dissemination and Impact

The appreciation of my research works have been effective through various actions.

[MCF1] position 61MCF932, 61st CNU section for IUT de l'Indre, University of Orléans

Date May 2013,

[MCF2] position 61MCF22, 61st CNU section for INSA Centre Val de Loire

Date May 2015,

I have been examining member of the Ph. D. thesis committee of the following doctorate candidate:

[TC1] Adrien Durant Petiteville,

Date the 20th January 2012, Doctorate degree from Paul Sabatier University, Toulouse, France.

Title Multi-sensor based navigation in cluttered environment

Supervision Viviane Cadenat and Prof. Michel Courdesses both from Paul Sabatier University of Toulouse, France.

[TC2] Tao Li, Doctorate degree from Rennes University, France

Date the 14th February 2013,

Title Control of a tele-echography robot by visual servoing.

Supervision Francois Chaumette Senior researcher from Inria Rennes-Bretagne Atlantique, and Prof. Pierre Vieyres from University of Orléans.

[TC3] Moahmed Dkhil, Doctorate degree from Pierre and Marie Curie University, Paris 6, France.

Date the 4th April 2016,

Title Modeling, characterization and control of a magnetic microrobotic system at the air/liquid interface

Supervision Prof. Stéphane Régnier from Pierre and Marie Curie University, Paris, and Micha el Gauthier senior researcher from FEMTO-ST Institute, Besançon, France.

APPENDIX B

PERSONAL REFERENCES

My research activities have led to scientific publications that are listed in this appendix. The names of people's that I have supervised their works are underlined. Furthermore, the publications list here follows the Hcéres[1] proposed nomenclature [1].

B.1 ARTICLES

B.1.1 Articles in International peer-reviewed and referenced journals (ACL)

[ACL1] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. MRI-based microrobotic system for the propulsion and navigation of ferromagnetic microcapsules. *Minimally Invasive Therapy & Allied Technologies*, 19(3):pp. 157–169, June 2010. doi:10.3109/13645706.2010.481402.

[ACL2] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. Three-dimensional controlled motion of a microrobot using magnetic gradients. *Advanced Robotics*, 25(8):pp. 1069–1083(15), May 2011. doi:10.1163/016918611X568657. In 2013 one of the Advanced Robotics' most cited articles from 2011 publications.

[ACL3] Viviane Cadenat, **David Folio**, and Adrien Durand. A comparison of two sequencing techniques to perform a vision-based navigation task in a cluttered environment. *Advanced Robotics*, 26(5-6):pp. 487–514, March 2012. doi:10.1163/156855311X617470.

[ACL4] <u>Jungsik Kim</u>, Hamid Ladjal, **David Folio**, Antoine Ferreira, and Jung Kim. Evaluation of telerobotic shared control strategy for efficient single-cell manipulation. *IEEE Transactions on Automation Science and Engineering*, 9(2):pp. 402–406, April 2012. ISSN 1545-5955. doi:10.1109/TASE.2011.2174357.

[ACL5] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. Simulation and planning of a magnetically actuated microrobot navigating in arteries. *IEEE Transactions on Biomedical Engineering*, 60(4):pp. 994–1001, April 2013. doi:10.1109/TBME.2012.2236092.

[ACL6] <u>Nabil Amari</u>, **David Folio**, and Antoine Ferreira. Motion of a micro/nanomanipulator using a laser beam tracking system. *International Journal of Optomechatronics*, 8(1):pp. 30–46, April 2014. doi:10.1080/15599612.2014.890813.

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[1]"*Haut Conseil de l'évaluation de la recherche et de l'enseignement supérieur*" (Hcéres) or the High Council for Evaluation of Research and Higher Education an independent administrative authority.

[ACL7] Alexandre Krupa, **David Folio**, Cyril Novales, Pierre Vieyres, and Tao Li. Robotized tele-echography: an assisting visibility tool to support expert diagnostic. *IEEE Systems Journal*, 10(3):pp. 974–983, April 2014. ISSN 1932-8184. `doi:10.1109/JSYST.2014.2314773`.

[ACL8] Lyes Mellal, Karim Belharet, **David Folio**, and Antoine Ferreira. Optimal structure of particles-based superparamagnetic microrobots: application to MRI guided targeted drug therapy. *Journal of Nanoparticle Research*, 17(2):64, February 2015. ISSN 1572-896X. `doi:10.1007/s11051-014-2733-3`.

[ACL9] Bumjin Jang, Wei Wang, Samuel Wiget, Andrew Petruska, Xiangzhong Chen, Chengzhi Hu, Ayoung Hong, **David Folio**, Antoine Ferreira, Salvador Pané, and Bradley Nelson. Catalytic locomotion of core-shell nanowire motors. *ACS Nano*, 10(11):pp. 9983–9991, November 2016. `doi:10.1021/acsnano.6b04224`.

[ACL10] **David Folio**, Christian Dahmen, Antoine Ferreira, and Sergej Fatikow. MRI-based dynamic tracking of an untethered ferromagnetic microcapsule navigating in liquid. *International Journal of Optomechatronics*, 10(2):pp. 73–96, April 2016. `doi:10.1080/15599612.2016.1166305`.

[ACL11] Lyes Mellal, **David Folio**, Karim Belharet, and Antoine Ferreira. Modeling of optimal targeted therapies using drug-loaded magnetic nanoparticles for the liver cancer. *IEEE Transactions on Nano-Bioscience*, 15(3):pp. 265–274, April 2016. ISSN 1536-1241. `doi:10.1109/TNB.2016.2535380`.

[ACL12] **David Folio** and Antoine Ferreira. 2D robust magnetic resonance navigation of a ferromagnetic microrobot using pareto optimality. *IEEE Transactions on Robotics*, 33(3): pp. 583–593, 2017. ISSN 1552-3098. `doi:10.1109/TRO.2016.2638446`.

[ACL13] B. Sarkis, **David Folio** and Antoine Ferreira. Catalytic Tubular Microjet Navigating in Confined Microfluidic Channels: Modeling and Optimization. *IEEE/ASME Journal of Microelectromechanical Systems*, 99(9):pp. 1–11, 2018. `doi:10.1109/JMEMS.2018.2803803`.

B.1.2 Articles in unreferenced journals (ACLN)

[ACLN1] **David Folio**. *Les innovations en microrobotique pour le biomédical*. "*Prospective et Stratégie*", APORS Éditions, 7(1):pp. 69–78, 2017. `doi:10.3917/pstrat.007.0069`

B.2 BOOKS

B.2.1 Guest Editor (DO)

[DO1] Ashis Banerjee, **David Folio**, Sarthak Misra and Quan Zhou. Guest editors: "Design, Fabrication, Control, and Planning of Multiple Mobile Microrobots". *International Journal of Advanced Robotic Systems*, 2014. ISSN 1729-8806. `doi:10.5772/1`

B.**2.2** **Book Chapter**

[OS1] Karim Belharet, **David Folio**, and Antoine Ferreira. *Real-time software platform for in vivo navigation of magnetic micro-carriers using* MRI *system*, chapter 11. Number 51 in Biomaterials. Woodhead Publishing, Cambridge, October 2012. ISBN 9780857091307.

[OS2] Nabil Amari, **David Folio**, and Antoine Ferreira. *Encyclopedia of Nanotechnology*, chapter Nanorobotics for Synchrotron Radiation Applications, pp. 1–19. Springer Netherlands, Dordrecht, 2nd edition, 2016. `doi:10.1007/978-94-007-6178-0_100927-1`.

B.**3** **PROCEEDINGS IN INTERNATIONAL CONFERENCES(ACT)**

[ACT1] Karim Belharet, **David Folio**, and Antoine Ferreira. 3D MRI-based predictive control of a ferromagnetic microrobot navigating in blood vessels. In *IEEE RAS and EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob'2010)*, pp. 808–813, Tokyo, Japan, September 2010. `doi:10.1109/BIOROB.2010.5628063`.

[ACT2] Olivier Kermorgant, **David Folio**, and François Chaumette. A new sensor self-calibration framework from velocity measurements. In *IEEE International Conference on Robotics and Automation (ICRA'2010)*, pp. 1524–1529, Anchorage, Alaska, May 2010. `doi:10.1109/ROBOT.2010.5509219`.

[ACT3] Karim Belharet, **David Folio**, and Antoine Ferreira. Endovascular navigation of a ferromagnetic microrobot using MRI-based predictive control. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2010)*, pp. 2804–2809, Taipei, Taiwan, October 2010. `doi:10.1109/IROS.2010.5650803`.

[ACT4] Jungsik Kim, Dongjune Chang, Hamid Ladjal, **David Folio**, and Antoine Ferreiraand Jung Kim. Evaluation of telerobotic shared control for efficient manipulation of single cells in microinjection. In *IEEE International Conference on Robotics and Automation (ICRA'2011)*, pp. 3382–3387, Shanghai, China, May 2011. `doi:10.1109/ICRA.2011.5979868`.

[ACT5] **David Folio**, Christian Dahmen, Tim Wortmann, M. Arif Zeeshan, Kaiyu Shou, Salvador Pane, Bradley J. Nelson, Antoine Ferreira, and Sergej Fatikow. MRI magnetic signature imaging, tracking and navigation for targeted micro/nano-capsule therapeutics. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2011)*, pp. 1297–1303, San Fransisco, CA, USA, September 2011. `doi:10.1109/IROS.2011.6048651`.

[ACT6] Karim Belharet, **David Folio**, and Antoine Ferreira. Control of a magnetic microrobot navigating in microfluidic arterial bifurcations through pulsatile and viscous flow. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2012)*, pp. 2559–2564, Vilamoura, Algarve, Portugal, October 2012. `doi:10.1109/IROS.2012.6386030`.

[ACT7] Christian Dahmen, **David Folio**, Tim Wortmann, Alexander Kluge, Antoine Ferreira, and Sergej Fatikow. Evaluation of a MRI based propulsion/control system aiming at targeted micro/nano-capsule therapeutics. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2012)*, pp. 2565–2570, Vilamoura, Algarve, Portugal, October 2012. `doi:10.1109/IROS.2012.6386244`.

[ACT8] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. Untethered microrobot control in fluidic environment using magnetic gradients. In *International Symposium on Optomechatronic Technologies (ISOT'2012)*, pp. 1–5, October 2012.

[ACT9] <u>Nabil Amari</u>, **David Folio**, and Antoine Ferreira. Robust laser beam tracking control using micro/nano dual-stage manipulators. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2013)*, pp. 1543–1548, Tokyo Big Sight, Japan, November 2013. doi:10.1109/IROS.2013.6696554.

[ACT10] <u>Nabil Amari</u>, **David Folio**, <u>Karim Belharet</u>, and Antoine Ferreira. Motion of a micro/nanomanipulator using a laser beam tracking system. In *International Symposium on Optomechatronic Technologies (ISOT'2013)*, Jeju Island, Korea, October 2013.

[ACT11] <u>Karim Belharet</u>, Yang Chunbo, **David Folio**, and Antoine Ferreira. Model characterization of magnetic microrobot navigating in viscous environment. In *International Symposium on Optomechatronic Technologies (ISOT'2013)*, Jeju Island, Korea, October 2013.

[ACT12] Nabil Amari, **David Folio**, and Antoine Ferreira. Robust tracking of a two-fingered micromanipulation system working through the focus of an optical beam. In *American Control Conference (ACC'2014)*, pp. 1613–1618, Portland, OR, USA, June 2014. doi:10.1109/ACC.2014.6859244.

[ACT13] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. Vision-based forces characterization of magnetic microrobot in a viscous environment. In *IEEE International Conference on Robotics and Automation (ICRA'2014)*, pp. 2065–2070, Hong Kong, China, May 2014. doi:10.1109/ICRA.2014.6907133.

[ACT14] Nabil Amari, **David Folio**, and Antoine Ferreira. Robust nanomanipulation control based on laser beam feedback. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2014)*, pp. 4674–4679, Chicago, IL, USA, September 2014. doi:10.1109/IROS.2014.6943226.

[ACT15] <u>Karim Belharet</u>, **David Folio**, and Antoine Ferreira. Study on rotational and unclogging motions of magnetic chain-like microrobot. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2014)*, pp. 834–839, Chicago, IL, USA, September 2014. doi:10.1109/IROS.2014.6942656.

[ACT16] <u>Bruno Sarkis</u>, **David Folio**, and Antoine Ferreira. Catalytic tubular microjet propulsion model for endovascular navigation. In *IEEE International Conference on Robotics and Automation (ICRA'2015)*, pp. 3537–3542, Seattle, Washington, USA, May 2015. doi:10.1109/ICRA.2015.7139689.

[ACT17] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. Magnetic microbot design framework for antiangiogenic tumor therapy. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2015)*, pp. 1397–1402, Hamburg, Germany, September 2015. doi:10.1109/IROS.2015.7353550.

[ACT18] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. Optimal control of multiple magnetic microbeads navigating in microfluidic channels. In *IEEE International Conference on Robotics and Automation (ICRA'2016)*, pp. 1921–1926, Stockholm, Sweden, May 2016. doi:10.1109/ICRA.2016.7487338.

[ACT19] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. Estimation of interaction forces between two magnetic bolus-like microrobots. In *International Conference on Manipulation, Automation and Robotics at Small Scales (MARSS'2016)*, pp. 1–6, Paris, France, July 2016. `doi:10.1109/MARSS.2016.7561740`.

[ACT20] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. Motion control analysis of two magnetic microrobots using the combination of magnetic gradient and oscillatory magnetic field. In *International Conference on Manipulation, Automation and Robotics at Small Scales (MARSS'2017)*, pp. 1–6, Montreal, QC, Canada, July 2017. `doi:10.1109/MARSS.2017.8001917`.

B.4 ORAL COMMUNICATIONS

B.4.1 Invited Speaker in International or National Conferences (INV)

[INV1] **David Folio**. Bio-nanorobotics: A reality for tomorrow? Invited keynote speaker in International R&D Symposium: "biology and communications", Madrid, Spain, March 2012. Fundación Ramón Areces.

[INV2] **David Folio**. Micro/nano-robots thérapeutique pour le traitement cibler du cancer. Invited speaker in Colloque International: "Quelles nanotechnologies pour la médecine", Rabat, Morocco, November 2014.

[INV3] **David Folio**. Innovation en microrobotique pour le biomédical. Invited speaker in Colloque "les futurs de l'innovation", Bourges, France, June 2015. Prospective et Stratégie.

B.4.2 Communications in International or National Conferences (COM)

[COM1] <u>Nabil Amari</u>, **David Folio**, and Antoine Ferreira. Robust tracking of a two-fingered nanomanipulation system working through the focus of a x-ray beam. Presented in the *Workshop on Automation of Assembly and Packaging at the Micro/Nano-scale*, Trieste, Italy, August 2011.

[COM2] **David Folio** and Antoine Ferreira. Endovascular navigation of magnetic microcarriers using a MRI system. Presented in the *Workshop on Magnetically Actuated Multiscale Medical Robots*, Vilamoura, Algarve, Portugal, October 2012.

[COM3] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. *Modélisation et Commande d'un injecteur microrobotique pour le traitement du cancer*. Presented in *Journée de jeunes chercheurs organisée par le laboratoire* PRISME, Blois, France, June 2015.

[COM4] <u>Lyes Mellal</u>, **David Folio**, Karim Belharet, and Antoine Ferreira. *Modélisation et Commande de Microrobot Magnétiques pour le traitement ciblé du Cancer*. Presented in *Journée de jeunes chercheurs organisée par l'*INSA Centre Val de Loire, France, June 2016.

REFERENCES

[1] *Bibliothèque nationale de France.* (2018) Cadre de classement. [Online]. Available: `http://production-scientifique.bnf.fr/Annexe/cadre-de-classement`

INDEX OF TERMS AND NOTATIONS

ACRONYMS

AMiR Division Microrobotics and Control Engineering
ANR *Agence Nationale de la Recherche*

ENSI *École Nationale Supérieur d'Ingénieurs*
ETH *Eidgenössische Technische Hochschule Zürich*

HETD Equivalent TD hours, in French "*heures équivalentes TD*" (hETD) is the reference hour to calculate the teaching duties. The rules are as follows: 1 h of course = 1.5 hETD, while the others, *e.g.*, 1 h of tutorial (TD) = 1 h of practical work (TP) = 1 hETD.

INSA *Institut National des Sciences Appliquée*
IRIS Institute of Robotics and Intelligent Systems

MAE Department of Mechanical and Automation Engineering
MRI Magnetic Resonance Imaging
MSRL Multi-Scale Robotics Lab

NANOMA Nano-Actuators and Nano-Sensors for Medical Applications

PHC *Partenariats Hubert Curien*
PIANHO Innovative Haptic Instrumental platform for 3D Nano-manipulation
PRISME *Laboratoire Pluridisciplinaire de Recherche en Ingénierie des Systèmes, Mécanique, Énergétique*
PROSIT Robotic Platform for an Interactive Tele-echographic System
PROTEUS Robotic Platform to facilitate transfer between Industries

GLOSSARY

AMiR

Division Microrobotics and Control Engineering (AMiR) (or in German "*Abteilung für Mikrorobotik und Regelungstechnik*") of the University of Oldenburg, Germany, headed by Prof. Dr.-Ing. Sergej Fatikov. `http://www.amir.uni-oldenburg.de`

MAE

Department of Mechanical and Automation Engineering (MAE) of the Chinese University of Hong Kong, with Prof. Li Zhang (). `http://www.mae.cuhk.edu.hk`

MSRL

Multi-Scale Robotics Lab (MSRL) is a part of the IRIS, a group of the Swiss Federal Institute of Technology (ETH), Zurich, headed by Prof. Bradley Nelson. `http://www.msrl.ethz.ch`

NANOMA project

The NANOMA project is an European project funded under FP7 ICT 2007.3.6, Micro/nanosystems, coordinated by Professor Antoine Ferreira, University of Orléans , PRISME Laboratory. The NANOMA project aims at proposing novel controlled nanorobotic delivery systems which will be designed to improve the administration of drugs in the treatment and diagnosis of breast cancer.

PIANHO project

The PIANHO project is an ANR P3N (2009) project.

The motivation of this project is to create a nanomanipulation platform capable of pick, hold and place nano-objects in the synchrotron radiation beam of the ESRF (Grenoble, France) via tuneable tool-object interaction.

PRISME Laboratory

The PRISME Laboratory is from University of Orléans and INSA Centre Val de Loire (EPRES 4229), `http://www.univ-orleans.fr/PRISME`.

The PRISME laboratory seeks to carry out multidisciplinary research in the general domain of engineering sciences over a broad range of subject areas, including combustion in engines, energy engineering, aerodynamics, the mechanics of materials, image and signal processing, automatic control and robotics. The laboratory is splited in 2 units: i) Fluids, Mechanics, Materials, Energy (F2ME) and ii) Images, Robotics, Automatic control and Signal (IRAuS). There are some 170 research professors, engineers, technicians and Ph. D. students working for this laboratory across several sites in Bourges, Orléans, Chartres, and Châteauroux.

PROSIT project

The PROSIT project is an ANR Contint program (2008) project, coordinated by Professor Pierre Vieyres, University of Orléans , PRISME Laboratory.

The goal is to develop an interactive and complex master-slave robotic platform for a medical diagnosis application (*i.e.*, tele-echography) based on a well defined modular control architecture.

PROTEUS project

The PROTEUS project is an ANR ARPEGE program (2009) project.

This project motivation was to help organizing interactions between academic and industrial partners of the french robotic community by providing suitable tools and models. Especially, one goal is to create a portal for the French robotic community as embodied by the *GDR Robotique* and its affiliated industrial partners, in order to facilitate transfer of knowledge and problems among this community.