Bassem DAHROUG

PhD, Mechatronics Engineer

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Professional Summary

Experienced robotics and mechatronics engineer with a PhD in Engineering Sciences and ten years of hands-on experience in space robotics, surgical robotics, and advanced control systems. Passionate about developing autonomous systems and digital twins for challenging environments.

Field of Interest

Mechatronics Design - Robotics - Automatic control - Visual servoing - Programming - Mechanics - Fluid mechanics - (micro)Manufacturing - Materials - Electronics

Skills

Robotic experimentation - Mechatronic design - Automatic control - Scientific programming - Mechanics - Electronics

Know-how

Organization, rigor and autonomy - Analysis, synthesis and solving problems - Oral and writing communication - Project Collaboration

Education

Doctor of Philosophy in Engineering Sciences *Nov. 2014 – Feb. 2018*
UBFC, Besançon, France

- **Dissertation**: Minimally Invasive Surgery in the Middle Ear: a guided micro-robotic system to efficiently remove cholesteatoma.

Master degree in Mechatronics and Micro-Mechatronics Systems *Sep. 2012 – Sep. 2014*
joint masters degree from **ENSMM**, Besançon, France and **EPI**, Gíjon, Spain

- **Master thesis**: Design, modelling and control of a contactless modular conveyor.

Bachelor degree in Mechanical Engineering *Sep. 2006 – Sep. 2011*
AAST, College of Engineering Studies and Technology, Department of Mechatronics, Alexandrie, Egypt

- **Graduation project titre**: Mobile robot control for parking manoeuvre.

Professional and Academic Experiences

Robotics Engineer - Control & Mechatronics *Mar. 2023 – Jun. 2025*
ROVIAL Space, Toulouse, France

- participate in the research and development of robotic systems for on-orbit servicing applications
  - design and develop mechatronic systems by using different robotic structures (e.g., manipulator arm, legged robot) for performing assembly and repair tasks;
  - develop a low-level controller for actuating the robotic system;
  - develop a high-level controller for computing forward and inverse kinematics controllers, as well as dynamics ones;
  - develop a perception controller to guide the robotic system throughout its various tasks;
  - develop a scientific simulation for robotic systems and their digital twin;
  - create experimental proof-of-concept to validate the developed robotic system;
  - integrate and test the various components of the developed robotics system;
- collaborates with other departments, such as Structure and Space, to gather requirements and specifications;

- review the robotics part of the projects that have been proposed for public funds;
- co-supervision of one master trainee;
- more information about my contribution to this project is available on the website https://bdahroug.github.io/2023/01/01/rovial.html.

Temporary teaching *Sep. 2021 – Jan. 2022*

ENSMM, Besançon, France

- 20 hours of practical work of JAVA programming for students in the 1^{st} year of bachelor.

Mechatronics Engineer *Jun. 2021 – Nov. 2022*

AMAROB Technologies, Besançon, France

- participate in the research and development of the main product of the company which is a micro-robotic systems dedicated to intracorporeal laser surgery;
  - design of a mechatronics device to actuate a blendable micro-robot;
  - manufacturing some parts of the micro-robot;
- take part in the company activities with its collaborators and client;
  - design and fabricate a medical prototype for detecting the breast cancer;
  - manufacturing using milling and electrical discharge machines.
- co-supervision of one undergraduate trainee.

Temporary teaching *Sep. 2019 – Jan. 2020*

UFC, Besançon, France

- 28 hours of practical work of robotics for the **ISIFC** students in the 3^{rd} year of bachelor;
- 12 hours of practical work of 3D computer vision for the students in the 2^{nd} year of master;
- 9 hours of practical work of automatic control of continuous system for the students in the 3^{rd} year of bachelor.

Researcher, Post-doctoral *Sep. 2018 – Dec. 2020*

Institute FEMTO-ST, Department AS2M, Besançon, France

- participate to the INSERM project "*ROBOT*" (Robotics and Optical coherence tomography for optical BiOpsy in the digestive Tract) [2017 – 2021] which proposes an innovative approach to detect the cancer cells at the digestive tract;
- implement a visual servoing scheme based on the 3D imaging (C-scan) obtained from the OCT (Optical Coherence Tomography) for guiding a robot during the intra-operative phase in order to perform a repeatable optical biopsy;
- design and development of a prototype in order to validate and integrate the distinct technological and methodological approaches proposed by the different projects teams;
- supervision of two undergraduate trainees;
- more information about my contribution to this project, as well as demonstration video, is available on the website https://bdahroug.github.io/2020/01/01/robot.html;
- valorization of the dissertation work.

Temporary teaching *Sep. 2015 – Jan. 2016*

ENSMM, Besançon, France

- 64 hours of practical work of automatic control and programming for students in the 1^{st} year of bachelor.

Research assistant, PhD student *Nov. 2014 – Feb. 2018*

Institute FEMTO-ST, Department AS2M, Besançon, France

- early research stage of the project "$\mu RMES$" (Micro-Robot for Middle Ear Surgery)
  - analysis of the clinical need for middle ear surgery to treat the disease known as cholesteatoma;
  - development of an image-guided micro-robotic system to perform this procedure.
- collaboration with **ARTOG** Center, Bern, Switzerland, by conducting experimental tests to evaluate the proposed controller in a clinical environment;
- supervision of six undergraduate trainees;

- more information about my contribution to this project, as well as demonstration video, is available on the website https://bdahroug.github.io/2018/01/01/uRMES.html.

Master graduation project *Feb. 2014 – Aug. 2014*

Institute FEMTO-ST, Department AS2M, Besançon, France

- participate to the project "*Smart Block*" [2011 – 2015] which innovates the transportation of fragile objects by designing a modular and reconfigurable conveyor;
  - propose new designs for a modular block which builds an aerodynamic conveyor for transporting photovoltaic cells;
  - model the air jets below an object;
  - propose control law to control the opening of the ports of each block independently so that the object can maintain a fixed position or follow a desired trajectory;
  - numerical and experimental validation of the proposed controller;
  - more information about my contribution to this project, as well as demonstration video, is available on the website https://bdahroug.github.io/2014/01/01/smartBlocks.html.

Temporary teaching *Feb. 2012 – Jul. 2012*

AAST, Department of Mechanics, Alexandria, Egypt

- practical work of robotics and CAD (Computer Aided Design);
- tutor of a university team participating in the 11^{th} MATE (Marine Advanced Technology Education Centre) International ROV Competition.

Bachelor graduation project *Feb. 2012 – Jul. 2012*

AAST, Department of Mechanics, Alexandria, Egypt

- model and control of a mobile robot (car-like vehicle) for performing an automated parking maneuver.

Scholarship and Awards

- 2016 International mobility grant for doctoral students, funded by **UBFC**
- 2015 Best Automation Paper Award, **ICRA** (IEEE Internaltional Conference on Robotics and Automation)
- 2012 European Scholarship, Master **EU4M** (Mechatronics and Micro-Mechatronics Systems) funded by the Erasmus Mundus programme
- 2008 Participation in competition, **Robocon** (Egypt) with AAST team, 4th place in Egypt

Computer skills

- **Computer Aided Design (CAD)** : FreeCAD, Solidworks, CATIA, 3DExperience, Creo
- **Computer Aided Manufacturing (CAM)** : G-Code, FreeCAD-Path, Vericut, GO2Cam
- **Electronic Design Automation (EAD)** : KiCAD, Egale, Proteus, Quartus
- **Mathematics** : Matlab/Simulink, Octave
- **Numerical Modeling** : COMSOL Multiphysics
- **Programming** : C/C++, CMake, Python, Java, JS, HTML, CSS, micro-controller, Ladder, TCP/IP, I2C
- **Vision & Perception** : ViSP, OpenCV, PCL
- **Robotics libraries** : Webots, RBDyn, DART, Bullet
- **3D computer graphics** : Magnum, VTK, Blender
- **Version Control** : GIT, SVN
- **Operating Systems** : Linux, RTEMS, Windows
- **Planning** : Gantt

Linguistics

English - French - Arabic - Spanish