

Research and development in robotics

WORK EXPERIENCE:

- Since January 2018:* Wandercraft in Paris: **Director of the Embedded Systems department:**
- Responsible for the full **development of the exoskeleton's electronic hardware**
 - Schematics/routing of **electronic boards** destined to embed sensors and control actuators.
 - Conception of **batteries** and robot wiring.
 - Design of specific test benches for validation and production.
 - Monitoring of transfer from R&D to **production**.
 - Compliance with medical standards **60601** regarding **electric safety and EMC**.
 - Responsible for **software development** in compliance with **62304** and **62366** standards (respectively regarding safety critical software for class A and B applications, and usability):
 - Monitoring of the main **embedded application's** development on QNX operating system.
 - Management of the Qt interface's development, with consideration for user experience (**UX**).
 - Responsible for the development of the software embedded into the **microcontrollers** on boards developed in-house.
 - Definition of the company's **software development process**.
 - Validation of all the documentation produced regarding software development.
 - Responsible for defining product requirements and corresponding tests, as well as driving **risk analysis processes** in compliance with the **ISO14971** standard.
 - **Management** of two teams (hardware and software) amounting to a total 15 people.
 - Management of the department **budget**.
 - Planning of the department's **roadmap**.
- January 2016 / January 2018 :* Wandercraft in Paris: **Head of the Hardware platform team :**
- In charge of the complete **development of the electronic hardware** of the exoskeleton.
 - Compliance with **medical norms 60601** regarding electrical safety/CEM.
 - **Software project leader** of the development of the graphical interface realized with Qt.
 - In charge of the compliance with **norms 62304 and 62366** regarding safety critical software and usability.
 - **Management** of a 3 person's team.
- July 2014 / January 2016 :* Wandercraft in Paris: **R&D engineer** in mechatronics. Participation to the electrical and computing development of a lower limbs **robotized exoskeleton**.
- March/May 2014 :* Institut des Sciences du Mouvement in Marseille : Postdoc as a **robotician** :
- Modelling, simulation and mechanical design of an innovative quadrotor.
- 2009/2013:* Institut des Sciences du Mouvement in Marseille: **Ph.D in bio-inspired robotics** entitled "Bio-inspired visually guided strategies for Micro Aerial Vehicles"
- Development and characterization of new optic flow sensors.
 - Simulation and design of a bio-inspired robot.
 - Teaching assistant at Aix-Marseille university and engineering school.
- February/June 2009:* Centre National d'Etudes Spatiales (CNES – French spatial agency) in Toulouse: **Training period**. Development of a particle counter based on infrared light diffraction.
- June/August 2008:* Emulsar in Chatenay-Malabry: **Technical training period**. Design of the electronics of a tensiometer for emulsion analysis.
- June/August 2007:* Portaventura (**Spain**): Temporary work as ride assistant in Cataluña.

EDUCATIONAL BACKGROUND:

- 2009/2013:* Institut des Sciences du Mouvement (ISM) de Marseille: **Ph.D** in biorobotics obtained with highest honors.
- 2004/2009:* Institut National des Sciences Appliquées de Toulouse (INSAT): **Engineering degree**.
➤ Speciality Automatics, Electronics. Valedictorian in 2nd, 3rd and 4th years.
- August/December 2008:* **University of Texas** in Austin (USA): semester study abroad.
➤ Robotics, Biomedical Electronics, System Theory.
- June 2004:* French **High School Diploma**. Obtained with high honors.

LANGUAGES :

- French:* Mother tongue.
- English:* Fluent, studied during 11 years. **IELTS 8.5** (September 2014), **TOEIC 895** (April 2007) and gained from living **six months in Austin** (USA) in 2008.
- Spanish:* Fluent, studied during 9 years. Gained from living **three months in Spain** in 2007.

COMPUTER SKILLS:

- Electronics:* Regular use of Matlab/Simulink, Labview, Control Desk, Eagle, SolidWorks, Altium designer, Proteus and PSpice. Good knowledge of microcontrollers and some know-how about VHDL programming.
- Programming:* Familiar with C/C#/C++ (QT), ADA, Java and Matlab languages and real time programming on QNX. Good knowledge of Internet languages: HTML5, CSS3, PHP, SQL and Flash. Familiar with Git and SVN versioning. Regular use of static analyzers : Cppcheck, pclint, sonarqube, valgrind.
- Software:* Office suite (with VBA programming), LaTeX language (Texmaker, Lyx), Inkscape, Gimp.

EXTRAPROFESSIONAL ACTIVITIES:

- Robotics:* **President of the robotics' club** of INSA Toulouse (2006/2008).
- Sports:* Volleyball, Handball, Running, drones.

RESEARCH INTERESTS:

Characterization of **optic flow sensors** robust to illuminance changes.

Design and development of a CURVed Artificial Compound Eyes in the framework of the **European project CURVACE**.

Optic flow regulation on **bio-inspired Micro Aerial Vehicles**.

Development of a sound sensor inspired by crickets in the framework of the project **SONOBOT**.

PUBLICATIONS:

Journal papers:

- **F. Expert** and F. Ruffier (2015), *Flying over uneven moving terrain based on optic-flow cues without any need for reference frames or accelerometers*, **Bioinspiration & Biomimetics**, 10, 026003.
- S. Mafrica, S. Godiot, M. Menouni, M. Boyron, **F. Expert**, R. Juston, N. Marchand, F. Ruffier, S. Viollet (2015), *A bio-inspired analog silicon retina with Michaelis-Menten auto-adaptive pixels sensitive to small and large changes in light*, **Optics Express**, 23(5):5614-5635.
- S. Viollet, S. Godiot, R. Leitel, W. Buss, P. Breugnon, M. Menouni, R. Juston, **F. Expert**, F. Colonnier, G. L'Eplattenier, A. Brückner, F. Kraze, H. Mallot, N. Franceschini, R. Pericet-Camara, F. Ruffier, D. Floreano (2014), *Hardware architecture and cutting-edge assembly process of a tiny curved compound eye*, **Sensors (MDPI-Basel)**, 14(11): 21702-21721.
- D. Floreano, R. Pericet-Camara, S. Viollet, F. Ruffier, A. Brückner, R. Leitel, W. Buss, M. Menouni, **F. Expert**, R. Juston, M. K. Dobrzynski, G. L'Eplattenier, H. A. Mallot and N. Franceschini (2013), *Miniature curved artificial compound eyes*, **Proceedings of the National Academy of Sciences**, 110(23):9267-72.
- F.L. Roubieu, **F. Expert**, G. Sabiron and F. Ruffier (2012) *Two-directional 1-gram visual motion sensor inspired by the fly's eye*, **IEEE Sensors Journal**, 13 (3):1025-1035.
- **F. Expert**, S. Viollet and F. Ruffier (2011) *Outdoor field performances of insect-based visual motion sensors*, **Journal of Field robotics**, Wiley, 28 (4):529 -541.

Patents:

- F. Ruffier and **F. Expert** *Motion sensor assembly for determining the angular velocity of a moving contrast in its field of view with a high accuracy*, **BET 12P280**.
- F. Ruffier and **F. Expert** *Dispositif et procédé de repérage de terrain en vol pour microdrone*, **BFF 13P0697**

Book chapter:

- **F. Expert** and F. Ruffier (2015) *The Vertical Optic Flow : An Additional Cue for Stabilizing Beerotor Robot's Flight Without IMU*, **Biomimetic and Biohybrid Systems**, Springer International Publishing Switzerland
- T. Raharijaona, L. Kerhuel, J. Serres, F. Roubieu, **F. Expert**, S. Viollet, F. Ruffier and N. Franceschini (2013) *Insect Inspired Visual Motion Sensing and Bio-Inspired Flying Robots*, **Handbook of biomimetics and bioinspiration**.

Peer-reviewed proceedings:

- A. Desbiez, **F. Expert**, M. Boyron, J. Dipéri, S. Viollet and F. Ruffier (2017) *X-Morf: a crash-separable quadrotor that morphs its X-geometry in flight*, **Research, Education and Development of UAS**, Oct 2017, Linköping, Sweden
- **F. Expert**, F.L. Roubieu and F. Ruffier (2012) *Interpolation based "time of travel" scheme in a Visual Motion Sensor using a small 2D retina*, **IEEE Sensors Conference**, Taipei, Taiwan, p.2231-2234.
- **F. Expert** and F. Ruffier (2012) *Controlling docking, altitude and speed in a circular high-roofed tunnel thanks to the optic flow*, **IEEE International Conference on Intelligent Robots and Systems (IROS)**, Vilamoura, Portugal, p.1125-1132
- F. Ruffier and **F. Expert** (2012) *Visual motion sensing onboard a 50-g helicopter flying freely under complex VICON-lighting conditions* **IEEE Conference on Complex Medical Engineering**, Kobe, Japan, p.634-639.
- R. Pericet-Camara et al. (2011) *CURVACE - CURVed Artificial Compound Eyes*, **2nd European Future Technologies Conference and Exhibition**, Budapest, Hungary, p.308-309.
- **F. Expert**, S. Viollet and F. Ruffier (2011) *A mouse sensor and a 2-pixel motion sensor exposed to continuous illuminance changes*, **IEEE Sensors conference**, Limerick, Ireland, p.974-977.
- F.L. Roubieu, **F. Expert**, M. Boyron, B.-J. Fuschlock, S. Viollet, and F. Ruffier (2011) *A novel 1-gram insect based device measuring visual motion along 5 optical directions*, **IEEE Sensors conference**, Limerick, Ireland, p. 687-690.
First place "Best Student Paper Award".
- F. Ruffier, S. Benacchio, **F. Expert**, E. Ogam (2011) *A tiny directional sound sensor inspired by crickets designed for Micro-Air Vehicles*, **IEEE Sensors conference**, Limerick, Ireland, p.970-973.

Ph.D. thesis dissertation:

- **F. Expert** (2013) *Flying robot inspired by insects: From optic flow sensing to visually guided strategies to control a Micro Aerial Vehicle*. **Winner of the George Giralt European PhD award. 2nd of the GDR-robotique PhD award.**

REFERENCES:

*Institute of
Movement Science
Queensland Brain
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EPFL (Switzerland)*

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