



Bob Aubouin–Pairault

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Education

- 2021- **PhD thesis**, GIPSA-lab and VERIMAG , Univ. Grenoble Alpes
Subject : Data-based anesthesia modelling for prediction and monitoring.
Thesis supervisor : Thao DANG (VERIMAG), co-supervisor : Mirko FIACCHINI (GIPSA-lab)
- 2020-21 **Master's Degree in systems control**, Ecole Centrale de Lyon, Lyon, France
- 2017-21 **Engineering school**, Ecole Centrale de Lyon, Lyon, France
- 2015-17 **Preparatory classes for engineering school**, Lycée François Arago, Perpignan, France

Work Experiences

- 2021 **Master Thesis**, 6 months, IMS laboratory, Bordeaux, France
Subject : : Toward Robust and Resilient Cyber-Physical Systems : State Awareness and Control under Physical faults and Cyber-attacks
Supervisors : Christophe COMBASTEL, Arthur PERODOU
- 2020- 21 **Self-employed as engineer student**, 5 months, Lyon, France
Electrical design and manufacturing of a prototype of divider-regrouper for the food industry.
- 2017-21 **Electrical design leader** 4 years, EPSA team, Lyon, France
Electrical design and manufacturing of a thermal car (2017-19) and then electric (2020) to participate in the Formula Student. Global modeling and exploitation of test data on Matlab.
- 2020 **Trainee in electronic and 3D printing**, 5 months, TAQT, Lyon, France
Design of a test bench for electronic PCB and implementation of rapid prototyping via 3D printing.
- 2019-20 **Trainee in 3D computing**, 4 months, Diocles, Lisbon, Portugal
Development of a body scanner for high-level athletes. Weekly link with research, daily use of Matlab, and working in a start-up with a multidisciplinary and international team.
- 2019 **Trainee mechatronics designer**, 6 months, GreenMot, Villefranche-sur-Saône, France
Development of a control strategy for a robot intended to move a manual gearbox. Management of the conception and manufacturing of a test bench for the validation of the control algorithms.

Skills

- Languages :** French (Mother tongue), English (TOEFL ITP 587/677), Spanish (A2).
- Programming Languages :** Python (Numpy, Pandas, Sklearn, Casadi, Bokeh, Pytorch), Matlab, C++ (Arduino), PLC (Siemens and Beckhoff).
- Software :** LaTeX, Git, Blender, CATIA V5, Eagle PCB, Cora, Office package.

Teaching experiences

2022	Practical classes on Industrial Control , 16h, Polytech Grenoble, supervised by Alina VODA
2018-19	Electrical energy and Systems Control tutor , 30h, Ecole centrale de Lyon

Research activities

Master thesis :

During my master thesis at the IMS laboratory (Bordeaux, France) under the supervisory of Christophe COMBASTEL and Arthur PERODOU, I have been working on resilient and robust control methods for cyber-physical systems under cyber attacks. For this purpose, I have studied Model Predictive Control and Set theory (with a specific focus on Ellipsoid and Zonotope sets). In addition to those theoretical tools, I have illustrated my work on a thermal building simulation subject to cyber-attacks. This work have been concluded with the participation in the IFAC *SafeProcess 2022* conference [1].

PhD thesis :

My PhD thesis is focused on a more practical goal with the global endpoint to create a prototype software to propose real-time support for general anesthesia. The project in which the thesis is included belongs to an international team of control theory researchers and anesthesiologists. To achieve our objective the idea is to use both learning tools along with the collected data set and theoretical tools to ensure the robustness of the proposed solutions.

Until now, I have mostly focused my attention on the literature of the field, trying to replicate previous existing results to feel comfortable and be able to compare them with our future results. I have also studied the available data sets to become familiar with medical data and learning algorithms.

In collaboration with anesthesiologists and the data management team of Grenoble hospital, we are now planning the data collection which will be labeled by experts to detect hemodynamic and respiratory events occurring during general anesthesia. This will help us to explain changes in vital signals with the first objective to alarm the practitioner and then to include that information in control methods.

In parallel, we are currently working on a MIMO MPC to propose control of drug injections based on the measurement of different vital signals rather than only the Bispectral Index which is the current state of the art.

Community involvement :

I have been reviewing papers for *IFAC Safeprocess 2022*, *IEEE RTSS 2022* conference and *Automatica* journal.

Publications :

1. B. Aubouin-Pairault, A. Perodou, C. Combastel, and A. Zolghadri, “Resilient tube-based MPC for Cyber-Physical Systems Under DoS Attacks,” IFAC-PapersOnLine, vol. 55, no. 6, pp. 278–284, Jan. 2022, doi : 10.1016/j.ifacol.2022.07.142.