AGUSTÍN GABRIEL YABO

Industrial Automation and Control Engineer
PhD in Automation, Signal and Image Processing

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I am a research scientist working on control theory and applications to life sciences. I resort to theoretical and numerical optimal control approaches to predict biological phenomena—such as regulatory mechanisms in bacterial cells—and to develop synthetic control strategies for industrial and biotechnological applications.

ACADEMIC EXPERIENCE

Postdoctoral researcher

MISTEA unit, INRAE Occitanie-Montpellier
Supervision: Céline Casenave

Jun 2022 – present Montpellier, France

Title: "Control of the aroma synthesis during wine fermentation process"

- Investigate novel real-time control strategies in wine fermentation for improving aroma composition and reducing energy consumption [6]. Control-oriented modeling of aroma synthesis in fermentation processes from experimental data.

PhD candidate

Biocore / McTao teams, Inria Sophia Antipolis - Méditerranée
Supervision: Jean-Luc Gouzé and Jean-Baptiste Caillau

Sep 2018 – Dec 2021 Nice, France

Obtained the PhD degree on **Automation, Signal and Image Processing** from the **Côte d'Azur University** in 2021.

Title: "Optimal resource allocation in bacterial growth: theoretical study and applications to metabolite production"

- Investigated optimal control strategies for synthesizing artificial metabolites in bacteria through growth rate regulation [4, 3, 12, 13, 15, 14], and designed model-predictive control loops for its production in industrial setups [11]. Examples in the ct-gallery.
- Different applications of computer science and systems theory to biological problems [1, 2, 7, 8, 5, 9, 10]. Examples in the ct-gallery.
- DCME activities: teaching and supervising the practical sessions (TD) of the courses Statistics and R (MAM3) and Time series (MAM4) of the *Applied mathematics and modeling* engineering degree at *Polytech Nice Sophia* (Sophia Antipolis, France).

Intern

Ctrl-A team, Inria Grenoble - Rhône Alpes
Supervision: Eric Rutten

Feb 2018 – Jun 2018 Grenoble, France

Obtained the master's degree on **Systems, Control & IT** from the **Grenoble Alpes University** in 2018.

Title: "A control-theory approach for cluster autonomic management: maximizing usage while avoiding overload"

- Design and validation of control-oriented system models for autonomic computing and self-management of High Performance Computing systems [18].
- Explored novel control strategies for autonomic resource management through optimal and predictive control approaches in real grid computing systems [16].

WORK EXPERIENCE

Project Engineer

R&D Department, G&L Group S.A.

2015 – 2017 Buenos Aires, Argentina

- Provided IT solutions (e.g. machine learning, computer vision, automation, control systems and IT infrastructure) and consulting services to companies and clients.
- Participated in domestic non-profit technological projects in cooperation with the Ministry of Science, Technology and Productive Innovation (Argentina).

Industrial Automation Engineer

Automation Department, Secin S.A.

2013 – 2014 Buenos Aires, Argentina

- Developed, implemented, tested and troubleshooted automation systems and control loops through Siemens programmable controllers.
- Acquired an overall understanding of manufacturing processes, as well as industrial instrumentation equipment.

Platform Analyst

IT Department, ICBC Argentina S.A.

2012 – 2013 Buenos Aires, Argentina

- Designed and programmed algorithms and scripts for automating IT processes.
- Acquired general knowledge of big-scale IT infrastructures, and implemented automated tasks on repetitive processes.

Research assistant

Science & Technology Department, National University of Quilmes

Supervision: Damián E. Oliva

July 2014 – Jul 2017 Buenos Aires, Argentina

Obtained the engineer's degree on **Industrial Automation and Control** from the **National University of Quilmes** in 2015.

- Developed real-time computer vision algorithms for vehicle tracking, measuring traffic flow parameters and detecting traffic jams in Python [20]. Implemented machine learning techniques for vehicle classification and statistical analysis of traffic flow [19].
- Worked on dynamical modeling and numerical simulation of arthropods' visual motion-sensitive neurons for studying and controlling their visuomotor behaviours [21, 17].
- Teaching assistant in Neural Networks and Control Systems courses. Prepared class exercises and activities focused on 1) automatic control systems design, modelling and simulation of dynamical systems and signal processing using MATLAB, and 2) solving clustering, regression and classification problems through machine learning techniques using MATLAB/Python.

GRANTS

2021 **EDSTIC PhD thesis prize**
2 awards granted per year to outstanding PhD theses from the ATSI (Automation, Signal and Image Processing) discipline.
Granted by Université Côte d'Azur (Nice, France).

2018 **EDSTIC PhD funding**
PhD funding (10 grants per year).
Granted by Université Côte d'Azur (Nice, France).

2018 **CORDI-S PhD funding**
PhD funding (4 grants per year).
Granted by Inria Grenoble - Rhône-Alpes (Grenoble, France).

2017 **LabEx PERSYVAL-Lab**
Master M2 scholarship program (10 grants per year).
Granted by LabEx PERSYVAL-Lab and Université Grenoble Alpes (Grenoble, France).

2016 **University and Transport**
Merit-based research scholarship for research assistants.
Granted by the Ministry of Education National University of Quilmes (Buenos Aires, Argentina).

2015 **SAI Research Subsidy Program**
Research support subsidy for undergraduate students.
Granted by National University of Quilmes (Buenos Aires, Argentina).

2014 **Santander Ibero-American Grants**
Exchange scholarship for a 1 semester stay in Spain.
Granted by Santander Bank (Spain) and National University of Quilmes (Buenos Aires, Argentina).

2013 **CONAHEC Student Exchange Program**
Short-stay exchange scholarship.
Granted by CONAHEC and National University of Quilmes (Buenos Aires, Argentina).

LANGUAGES

English ●●●●●
Fluent - IELTS Band 7.5

Spanish ●●●●●
Mother tongue

French ●●●●●
Fluent

Chinese ●●○○○
HSK Level 2

INTERESTS

Control systems
Mathematical biology
Optimal control
Computer vision
Machine learning
Coding

SKILLS

Python Julia Matlab C
C++ Latex Assembler SQL
Java OpenCV PHP Smalltalk
LUA JS VBScript

PUBLICATIONS

Each reference has a link to download the paper from HAL.

Conference Proceedings

[2] • **Yabo, A.** "Predicting microbial cell composition and diauxic growth as optimal control strategies". In: Submitted paper. . 2022.

[3] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Optimal allocation of bacterial resources in fed-batch reactors". In: *2022 European Control Conference (ECC)*. . IEEE. 2022.

[6] • **Yabo, A.** and C. Casenave. "Aroma synthesis and energy consumption in wine fermentation: a multiobjective optimization approach". In: Submitted paper. . 2022.

[9] • N. Augier and **Yabo, A.** "Time-optimal control of piecewise affine bistable gene-regulatory networks: preliminary results". In: *7th IFAC Conference on Analysis and Design of Hybrid Systems*. . 2021.

[10] • C. Djuikem, **Yabo, A.**, F. Grognard, and S. Touzeau. "Mathematical modelling and optimal control of the seasonal coffee leaf rust propagation". In: *7th IFAC Conference on Analysis and Design of Hybrid Systems*. . 2021.

[11] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Hierarchical MPC applied to bacterial resource allocation and metabolite synthesis". In: *2021 IEEE 60th Conference on Decision and Control (CDC)*. . IEEE. 2021.

[13] • **Yabo, A.** and J.L. Gouzé. "Optimizing bacterial resource allocation: metabolite production in continuous bioreactors". In: *21th IFAC World Congress*. . 2020.

[14] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Bacterial growth strategies as Optimal Control problems: maximizing metabolite production". In: *The 19th French-German-Swiss conference on Optimization (FGS'2019)*. 2019.

[15] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Singular regimes for the maximization of metabolite production". In: *The 58th Conference on Decision and Control (IEEE CDC 2019)*. . 2019.

[16] • **Yabo, A.**, O. Richard, B. Bzeznik, B. Robu, and E. Rutten. "A control-theory approach for cluster autonomic management: maximizing usage while avoiding overload". In: *The 3rd IEEE Conference on Control Technology and Application (IEEE CCTA 2019)*. . 2019.

[18] • E. Stahl, **Yabo, A.**, O. Richard, B. Bzeznik, B. Robu, and E. Rutten. "Towards a control-theory approach for minimizing unused grid resources". In: *The 1st Autonomous Infrastructure for Science Workshop (AI-Science'18)*. . 2018.

[19] • **Yabo, A.**, S. Arroyo, F. Safar, and D. Oliva. "Vehicle classification and speed estimation using computer vision techniques". In: *XXV Argentine Congress on Automatic Control (AADECA 2016)*. . 2016.

[20] • D. Oliva, **Yabo, A.**, L. Garcıa, S. Arroyo, and F. Safar. "Implementation of a traffic flow measurement and traffic jam detection system in highways". In: *Argentine Symposium on Artificial Intelligence (ASAI 2015)-JAIIO 44*. . 2015.

[21] • **Yabo, A.**, J. Carbone, S. Ibañez, D. Tomsic, and D. Oliva. "Wide-field stimulation system for measuring of visuomotor behaviors in arthropods". In: *XXIX Annual Meeting of the Argentine Society for Research in Neuroscience (SAN 2014)*. 2014.

Journal Articles

[1] • **Yabo, A.** "Optimal feedback allocation strategies in a generic class of bacterial growth models with multiple substrates". In: *Submitted paper* (2022). .

[4] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Optimal bacterial resource allocation strategies in batch processing". In: *Submitted paper* (2022). .

[5] • **Yabo, A.**, J.-B. Caillau, J.-L. Gouzé, H. de Jong, and F. Mairet. "Dynamical analysis and optimization of a generalized resource allocation model of microbial growth". In: *SIAM Journal on Applied Dynamical Systems* (2022). .

[7] • **Yabo, A.**, M. Safey El Din, J.B. Caillau, and J.L. Gouzé. "Stability analysis of a bacterial growth model through computer algebra". In: *Accepted paper* (2022). .

[8] • N. Augier and **Yabo, A.** "Time-optimal control of piecewise affine bistable gene-regulatory networks". In: *International Journal of Robust and Nonlinear Control* (2021). .

[12] • **Yabo, A.**, J.B. Caillau, and J.L. Gouzé. "Optimal bacterial resource allocation: metabolite production in continuous bioreactors". In: *Mathematical Biosciences and Engineering* (2020). .

[17] • J. Carbone, **Yabo, A.**, and D. Oliva. "Characterization and modelling of looming-sensitive neurons in the crab Neohelice". In: *Journal of Comparative Physiology A* (2018). .