Anthony Couthures

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Professional Experience

Contractual

May 2026–now **Postdoctoral Researcher**, *ICTEAM - UCLouvain*, Louvain-la-Neuve, Belgium
Performance Estimation Problem (PEP) for Control
Applying the PEP framework for the analysis of optimization problems in control. The main goal is to obtain certification of performance for control algorithms by providing worst-case guarantees.
Promotor: Julien M. Hendrickx & Gianluca Bianchin

Education

Formation

2022–2026 April **Doctoral Thesis**, *CRAN - CNRS - University of Lorraine*, Nancy
Supervisors: Samson Lasaulce & Irinel-Constantin Morărescu
Defense Date: 8th April 2026
Jury Members:
- President: Romain Postoyan (CRAN, Nancy)
- Examiner: Federica Garin (GIPSA-Lab, Grenoble)
- Reviewer: Antoine Girard (L2S, Saclay)
- Reviewer: Julien M. Hendrickx (UCLouvain, Louvain-la-Neuve)

Title: "Influence des dynamiques d'opinion sur le changement climatique : analyse et stratégies macroscopiques"
Thesis Topics:
- **Game Theory & Mechanism Design:** Modeling international climate negotiations as *Weighted Potential Games*; analysis of Nash Equilibria under non-linear environmental feedback; design of receding horizon strategies for cooperation.
- **Coupled Socio-Environmental Dynamics:** Mathematical characterization of the feedback loop between opinion dynamics and environmental degradation. Proof of existence of *Hopf* and *Pitchfork bifurcations* leading to oscillating or polarized regimes (oscillatory tragedy of the commons).
- **Networked Systems Analysis:** Development of the *Continuous Opinion Signaled Action (COSA)* model. Derivation of spectral thresholds for global synchronization and *Input-to-State Stability (ISS)* analysis of robust opinion clustering on complex networks.

2021–2022 **Master's in Research Mathematics**, *University of Paris-Saclay*, Orsay, *Mathematics and Applications*
M2 Optimization, specialization in Game Theory and Optimization

2020–2021 **Master's in Research Mathematics**, *University of Paris-Saclay*, Orsay, *Mathematics and Applications*
M2 Analysis Modeling Simulation, specialization in Analysis Modeling of PDEs

2017–2020 **Master's Preparation for Math Agrégation**, *University of Sciences and Technologies*, Bordeaux, *Fundamental Mathematics*
M1 Fundamental Mathematics, M2 preparation for Agrégation

2014–2017 **Bachelor's in Mathematics**, *University of Sciences and Technologies*, Bordeaux, *Fundamental Mathematics*
L1 MISMI (multidisciplinary), L2–L3 Fundamental Mathematics

Schools / Workshops

sept. 2024 **Grand Séminaire Multi-Agent Systems**, *GDR MACS*, Paris, Michael Defoort
One week workshop on Multi-Agent Systems

apr. 2024 **Game Theory with Engineering Applications**, *EECI*, Birmingham, Dario Bauso
One week class on Game Theory with Engineering Applications

may 2023 **MACS School 2023**, *GDR MACS*, Aussois, Dimitri Peaucelle
MACS School 2023: convex optimization for analysis and control of dynamical systems

2019 **Introduction to Dynamical Systems and Chaos**, *Santa Fe Institute*

Internships

apr.–oct. 2022 **M2 Research Internship**, *CRAN - University of Lorraine*, Nancy, Samson Lasaulce
Modeling COPs via game theory to study cooperative (or not) behaviors of participating governments

mar.–oct. 2021 **M2 Research Internship**, *LMO - University of Paris-Saclay*, Orsay, Nicolas Burq
"Hamiltonian PDEs: Lax-integrable, KAM and Gibbs Measure"

mar.–jun. 2020 **M2 Research Internship**, *IMB - University of Bordeaux*, Bordeaux, Michel Bonnefond
"When to Stop? Optimal Stopping Problem Applied to American Options"

apr.–may 2018 **M1 Supervised Research Work**, *University of Bordeaux*, Bordeaux, Philippe Jaming
"Counterexample to Lebesgue Measure Theory and Cantor Set"

may 2017 **L3 Supervised Research Work**, *University of Bordeaux*, Bordeaux, Laurent Bessières
"Banach-Tarski Paradox" Demonstration of the Banach-Tarski theorem

Publications

Notation: Myself, PhD Supervisor, Supervised, International Collaborator, Industrial Collaborator

Working Paper

- **Couthures, A.**, Bianchin, G., Hendrickx, J. (For ECC27) Worst-Case LTI Perturbations of Finite-Horizon LQR: A Performance Estimation Problem Approach. Conference paper.

PhD Thesis

- **Couthures, A.** (2026). Influence des dynamiques d'opinion sur le changement climatique : analyse et stratégies macroscopiques. PhD Thesis.

Journal Publications

4. **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2026) Link between equitable partitions and local agreements in multi-agent systems with nonlinear interactions. Nonlinear Analysis: Hybrid Systems, 61, 101754. https://doi.org/10.1016/j.nahs.2026.101754 [Hal Link]

3. **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2025). Global Synchronization of Multi-Agent Systems With Nonlinear Interactions. IEEE Control Systems Letters, 9, 354–359. https://doi.org/10.1109/LCSYS.2025.3573563 [Hal Link]

2. Mroué, B., **Couthures, A.**, Lasaulce, S., & Morărescu, I.-C. (2025). On the impact of cross-country imitation on climate change: A game-theoretical analysis. IFAC Journal of Systems and Control, 32, 100309. https://doi.org/10.1016/j.ifacsc.2025.100309 [Hal Link]

1. **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2024). Analysis of an opinion dynamics model coupled with an external environmental dynamics. Chaos, Solitons & Fractals, 189, 115719. https://doi.org/10.1016/j.chaos.2024.115719 [Hal Link]

Submitted Journal Papers

- **Couthures, A.**, Jayakumar Varma, A., Satheeskumar Varma, V., Lasaulce, S., Morărescu, I.-C. & Girard, A. (Under Revision). Social learning community detection with nonlinear interactions. Physical Review E. [arXiv Link]

- Munif, H., **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Başar, T.. (Under Review). "*Network-Induced Strategic Communication in Opinion Dynamics*". IEEE Transactions on Control of Network Systems. [arXiv Link]

- **Couthures, A.**, Bainier, G., Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (Second round of review). From global synchronization to robust clustering: multi-agent systems with nonlinear interactions. IEEE Transactions on Automatic Control. [arXiv Link]

Conference Publications

5. **Couthures, A.**, Bizyaeva, A., Satheeskumar Varma, V., Franci, A., & Morărescu, I.-C. (2025). Bifurcation analysis of an opinion dynamics model coupled with an environmental dynamics. 2025 IEEE 64th Conference on Decision and Control (CDC) [Hal Link]

4. **Couthures, A.**, Vogler, P., Beaude, O., Lasaulce, S., & Morărescu, I.-C. (2025). An Optimization Setup of the Decarbonization Problem in the Transportation Sector. In Network Games, Artificial Intelligence, Control and Optimization (pp. 131–141). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-78600-6_12 [Hal Link]

3. **Couthures, A.**, Mongaillard, T., Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2024). Analysis of a Continuous Opinion and Discrete Action Model Coupled with an External Dynamics. 2024 European Control Conference (ECC), 3392–3397. https://doi.org/10.23919/ECC64448.2024.10591291 [Hal Link]

2. Mroué, B., **Couthures, A.**, Lasaulce, S., & Morărescu, I.-C. (2024). A Quadratic Static Game Model for Assessing the Impact of Climate Change. In Complex Networks & Their Applications XII (pp. 383–394). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-53499-7_31 [Hal Link]

1. Mroué, B., **Couthures, A.**, Lasaulce, S., & Morărescu, I.-C. (2023). Une approche par la théorie des jeux du problème du choix des niveaux nationaux d'émissions de CO2. XXIXème Colloque Francophone de Traitement Du Signal et Des Images, GRETSI 2023. https://gretsi.fr/data/colloque/pdf/2023_mroue1148.pdf [Hal Link]

Journal Presented in Conference

- **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2026). Link between equitable partitions and local agreements in multi-agent systems with nonlinear interactions. IFAC World Congress 2026

- **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2025). Global synchronization of multi-agent systems with nonlinear interactions. 2025 IEEE 64th Conference on Decision and Control (CDC)

Extended Abstracts

- **Couthures, A.**, Mroué, B., Lasaulce, S., & Morărescu, I.-C. (2024). On the impact of cross-country imitation on climate change: A game-theoretical analysis. FAERE 2024.

- **Couthures, A.**, Satheeskumar Varma, V., Lasaulce, S., & Morărescu, I.-C. (2024). Analysis of a non-linear opinion dynamics model coupled with an external signal. ACNDC 2024

- **Couthures, A.**, Mroué, B., Lasaulce, S., & Morărescu, I.-C. (2023). A Planning Game for Global Decarbonization Strategies. PGMO days 2023.

- Mongaillard, T., Lasaulce, S., Satheeskumar Varma, V., **Couthures, A.**, & Sabir, E. (2023). Optimal Carbon Pricing Based on Dynamical Climate Model. PGMO days 2023.

- **Couthures, A.**, Mroué, B., Morărescu, I.-C., & Lasaulce, S. (2022). A static game model for analyzing country carbon emissions. PGMO days 2022

Preprint

- **Couthures, A.**, Mroué, B., Morărescu, I.-C., & Lasaulce, S.. (Preprint). A static game model for climate change analysis and strategy design. [Website Link] [SSRN Link]

Software Development

- **Couthures, A.** (2022). AnthonyCouthures/CO2-Game. https://github.com/AnthonyCouthures/CO2-Game (Published 2022) Documentation: https://anthonycouthures.github.io/CO2-Game/ [Zenodo Link]

- **Couthures, A.** (2024). AnthonyCouthures/Private-Transport-Sector-Optimization-Model. https://github.com/AnthonyCouthures/Private-Transport-Sector-Optimization-Model (Published 2024) [Zenodo Link]

- **Couthures, A.** (2025). AnthonyCouthures/COSA-Simulator. https://github.com/AnthonyCouthures/COSA-Simulator (Published 2025) [Zenodo Link]

Scientific outreach

Research Visits

jan. 2026 — Few days

International Research Visit, *University of Louvain*, Louvain-la-Neuve, Belgium, Host: Julien M. Hendrickx & Gianluca Bianchin

Visit to have a first interaction with the research group of Julien M. Hendrickx and Gianluca Bianchin for possible post-doctoral research project.

may 2025 — One week — **International Research Visit**, *University of Liège*, Liège, Belgium, Host: Alessio Franci & Anastasia Bizyaeva

Short research visit on coupled opinion-environment dynamics: the formulation and analysis of a continuous-time model combining a social influence network with an environmental state (perception/feedback loops); investigated equilibrium and local stability properties via Jacobian block-structure and eigenvalue characterizations; and consolidated the results into an internal project note to support ongoing collaboration.
Output: Article in preparation for submission.

oct. 2023 — One month — **Industrial/Laboratory Research Visit**, *EDF Lab Paris-Saclay*, Saclay, France, Host: Olivier Beaude

Research visit contributing to an optimization-based formulation for decarbonizing the private passenger transportation sector at regional scale: modeling modal shifts, fleet renewal and infrastructure investments under monetary and CO_2 budgets; and reformulation as a non-convex quadratic program including a congestion-aware Quality-of-Service objective.
Output: The conference paper 4.

Invited Talks/Posters

jan. 2026 — **Invited Talk**, *University of Louvain*, Louvain-la-Neuve, Belgium, Host: Julien M. Hendrickx & Gianluca Bianchin

Invited talk at the University of Louvain on the topic of the analysis of an opinion dynamics model coupled with an external environmental dynamics. [Link to the slides]

sept. 2024 — **Grand Séminaire Multi-Agent Systems**, *GDR MACS*, Paris, Michael Defoort

Poster presentation at the Grand Séminaire Multi-Agent Systems on the topic of the analysis of an opinion dynamics model coupled with an external environmental dynamics. [Link to the poster]

oct. 2024 — **PhD seminar**, *Institut Élie Cartan de Lorraine*, Nancy

Invited talk at the PhD seminar of IECL (other laboratory of the University of Lorraine) on the topic of the analysis of an opinion dynamics model coupled with an external environmental dynamics.

jun. 2024 — **Action Multi-Agent Systems**, *GDR MACS*, Paris

Invited talk at the Action GDR MACS on the topic of the analysis of an opinion dynamics model coupled with an external environmental dynamics.

oct. 2023 — **EDF Presentation**, *EDF Lab Paris-Saclay*, Saclay, France

Two presentations at the EDF Lab Paris-Saclay for the R31 OSIRIS team:
- Presentation on the Game theory & Mechanism Design approach to model the international climate negotiation.
- Presentation on the optimization-based formulation for decarbonizing the private passenger transportation sector at regional scale.

Participation to conferences

2024 — Presentation in person at the following conferences:
- European Control Conference 2024 (ECC) in Stockholm.
- Annual conference of the French Association of Environmental and Resources Economists (FAERE) in Strasbourg.
- NETGCOOP 2024 conference in Lille.

Teaching

Total hours: 120h on various courses

2024-2025 — **Teaching Assistant**, *ENSEM*, Vandoeuvre-lès-Nancy
- 20h (TD/TP): Optimisation with Pierre Riedinger (CRAN)
- 16h (TD): Probabilité et Statistique with Aurélie Gueudin (CRAN)
- 12h (TD): EDP / Distributions with Manfred Maadrish (IECL)

2024 — **Teaching Assistant**, *ENSGSI*, Nancy
- 32h (Cours/TD): Initiation à la Programmation with Christian Daul (CRAN) (supervision of projects, evaluation of exams)

2023-2024 **Teaching Assistant**, *IUT Nancy-Brabois*, Vandoeuvre-lès-Nancy

- 20h (TD/TP): Architecture des systèmes numériques et informatiques with Magalie Thomassin (IUT Nancy-Brabois)
- 20h (Cours/TD/TP): Intégration with Constantin Morărescu (CRAN) (Personal TD exercises, exam elaboration and evaluation)

Supervision & Mentoring

nov. 2025–present **Co-supervision of Research Project**, *Remote / International Collaboration*, with Dr. Vineeth Varma

Topic: "Spectral Community Detection algorithms based on Opinion Dynamics."
Mentee: Athira Varma Jayakumar (USA).
My contribution: Definition of the spectral clustering criteria, design of the stopping mechanisms (epsilon-parameters), and theoretical analysis of the convergence.
Outcome: Article in preparation for submission to *Physical Review E*.

apr.–may 2024 **Co-supervision of Research Project**, *Remote / EDF Collaboration*, with Dr. Prunelle Vogler

Topic: "Optimization setup of the decarbonization problem in the transportation sector."
Intern: Prunelle Vogler (EDF).
My contribution: Co-supervision of the intern, definition of the optimization setup based on the previous work at EDF, and help on mathematical modeling and optimization.
Outcome: Collaboration with EDF on the optimization setup of the decarbonization problem in the transportation sector published in the conference proceedings NetGCoop 2024.

Scientific Service

Reviewing Activities

2024–now **Reviewer for International Journals**

- Automatica
- IEEE Transactions on Automatic Control (TAC)
- IEEE Control Systems Letters (L-CSS)
- IEEE Transactions on Control of Network Systems (TCNS)
- IEEE Transactions on Network Science and Engineering (TNSE)
- Nonlinear Analysis: Hybrid Systems (NAHS)
- European Journal of Control (EJC)

2024–now **Reviewer for International Conferences**

- IEEE Conference on Decision and Control (CDC)
- IEEE European Control Conference (ECC)

Academic Service & collective responsibilities

Collective Responsibilities

2024–2026 **Commission Parité Member**, *CRAN*, University of Lorraine

Commission member of the CRAN laboratory and organization events to promote gender equality and diversity. Presentation of the commission at CRAN PhD day 2024 and 2025.

Before PhD

2018–2019 **Commission member**, *Bureau de la vie étudiante*, University of Bordeaux

Commission member of the Bureau de la vie étudiante: participation to the meetings, discussion of the university's projects on sustainable development, participation to the university's decisions, eco-responsibility actions ([Powerzee] in collaboration with ENGIE, etc.).

2017–2019 **Founding President**, *La Confrérie des Matheux*, University of Bordeaux

Association aimed at creating cohesion among students in Mathematics programs, scientific mediation, work support, social events. It creation with objectives to reduce social isolation and promote a sense of belonging among students.

Student Representative

2024–2026 **Student Representative and Board Member of the CRAN Council Laboratory**, *CRAN*, University of Lorraine

Student representative of the CRAN laboratory and organization of Phd events:

- Organization of the PhD day of the laboratory (1 day per year): Co-organized (with the other elected student representatives) the PhD Day to strengthen interactions among PhD students: defined the planning ; surveyed participants' and speakers' availability; issued the call for PhD presentations; coordinated logistics (rooms, coffee breaks, catering); handled administrative bookings for the restaurant and social activity (administrative requests, purchase requests) and prepared the budget; collected post-event feedback via surveys and delivered a summary report to the laboratory council.
- Participation to the laboratory council (every 4 months): participation to the laboratory council meetings, discussion of the laboratory's projects, participation to the laboratory's decisions (budget allocation, etc.).
- Participation to working groups on the valorization of PhD students' implications in the laboratory life (promoting the PhD students' interactions and their integration into the laboratory life)

Before PhD

2016–2020 **Student Representative**, *University of Bordeaux*, College of Sciences and Technologies, College Council & Mathematics and Interaction Training Unit Council (UFR)

2016–2020 **Student Representative**, *University of Bordeaux*, College of Sciences and Technologies, Mathematics and Interaction Training Unit Council

Other Commitments

present **PhD team seminar creation**

Helping the creation of the PhD team seminar in collaboration with the PhD students of the team.

dec. 2024 **Organizer of laboratory department's PhD day**, *CRAN*, University of Lorraine

Organization of the laboratory department's day: invitation of speakers, organization of the event, participation to the event, survey of participants, choosing the restaurant and activities. It is a day to promote the PhD students' interactions into the department.

2022–present **Tools and tips for PhD students**, *CRAN*, University of Lorraine

Help PhD students to navigate the PhD journey:

- Realisation of a pdf document to help PhD students to navigate the PhD journey: compiling practical tools, workflows, and best practices from the first year to the defense (literature search/management, LaTeXand writing, productivity tools, coding and version control, administrative steps, and publication/dissemination...).
- Short presentations of good practices to the new PhD students (only to the ones of the team for geographical reasons).

sept. 2022 **National Conference Organization**, *GRETSI*, Nancy

Operational support for GRETSI 2022 (Nancy): badge preparation and distribution, registration desk/welcome , attendee guidance and room logistics, microphone handling during sessions, and general on-site coordination with the organizing team.

Open Science

Feb. 2024 **Ma Thèse en 180 Secondes (MT180) – Regional Final**, *University of Lorraine*, Nancy

Selected to present at the regional MT180 final (3-minute research outreach competition). Delivered a 180-second talk introducing my PhD topic, Game Theory applied to climate change negotiations, to a broad audience. [Link to the video]

Languages

French Native language

English Fluent in reading, speaking, and writing *Books, articles, series in original version,...*

Programming Skills

LaTeX	Writing (reports, thesis, research papers), Inkscape, Tikz
Python	Modeling: matplotlib, scipy, pyomo, numpy, pytorch, numba, pandas, ipywidgets
Julia	Modeling: DifferentialEquations.jl, BifurcationKit.jl

Interests

Mathematics	Game Theory, Mechanism Design, Learning, Operational Research, Chaos
Learning	Reinforcement Learning, Image Recognition, Clustering, K-mean, Optimal Transport