

# Ihab HAIDAR

Associate professor at ENSEA

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*I was born in Beirut, Lebanon, in 1983. I received the Master's degree in mathematics from Aix-Marseille University in 2008 and the PhD degree from the University of Montpellier in 2011. Between 2012 and 2016, I was with CentraleSupélec at L2S and Sorbonne University at IMJ-PRG, successively. Since 2017, I am associate professor at ENSEA and a member of the Laboratoire Quartz. My main research interests include nonlinear control theory, switched systems, time-delay systems and biological systems.*

## Education

- 2008–2011 **University of Montpellier, PhD**, Applied mathematics.  
Topic: *Modeling and analysis of microbial dynamics in soil*  
Supervisor: Alain RAPAPORT
- 2007–2008 **Aix-Marseille University, Master 2**, Applied mathematics.  
Internship topic: *Approximation by diffusion of renewal equations*  
Supervisor: Assia BENABDALLAH
- 2002–2007 **Lebanese University, Hadath, Master 1**, Pure mathematics.

## Professional experiences

- Since 2017 **Associate professor, ENSEA**, Quartz Laboratory,.  
Research: *Control theory for renewable energy systems (microbial fuel cells, electrofermentation processes, twin wind turbine)*  
Teaching: mathematics and control theory
- 2016–2017 **Assistant professor, ENSEA**, Quartz Laboratory.  
Research: *Input-output linearization of time-delay systems*  
Teaching: mathematics and control theory
- 2014–2015 **Postdoc, Sorbonne University**, Institut de Mathématiques de Jussieu (IMJ).  
Topic: *Urban pigeon population management: approach based on viability theory*  
Supervisor: Hélène FRANKOWSKA
- 2013–2014 **Postdoc, CentraleSupélec**, Laboratoire des Signaux et Systèmes (L2S).  
Topic: *Converse Lyapunov theorems for uncertain time-varying delay systems*  
Supervisors: Paolo MASON and Mario SIGALOTTI
- 2012–2013 **Postdoc, CentraleSupélec**, Laboratoire des Signaux et Systèmes (L2S).  
Topic: *Analysis and control of time-delay systems for neurosciences applications*  
Supervisors: Antoine CHAILLET and William PASILLAS-LÉPINE

## Teaching activities

- Since 2022 **Nonlinear control theory, 3rd year, Automatics and electronics for industry option (AEI)**, ENSEA.  
In charge of the course + supervision of exercises and lab works for 20 students.

- 2021-2022 **Identification and optimal control**, 3rd year (AEI), ENSEA.  
In charge of the course + supervision of exercises and lab works for 20 students.
- Since 2021 **Nonlinear control theory**, 3rd year (AEI), ENSEA.  
Supervision of lab works.
- Since 2019 **Automatic control and systems**, 1st year, ENSEA.  
In charge of the course for 250 students.
- Since 2018 **Fourier analysis**, 1st year, ENSEA.  
In charge of the course for 70 students.
- 2018-2020 **Digital signal processing**, 1st year, ENSEA, .  
In charge of the course + supervision of exercises and lab works for 30 students.
- Since 2017 **Automatic control and systems**, 1st year, ENSEA.  
Supervision of exercises and lab works.
- Since 2017 **Linear systems**, 1st year, ENSEA.  
Supervision of exercises and lab works.
- Since 2017 **Mathematics**, 1st year, ENSEA.  
Supervision of exercises and lab works.
- 2015-2016 **Mathematical skills for engineers**, 3rd year, École Polytechnique Féminine (EPF).  
In charge of the course + supervision of exercises and lab works.
- 2015-2016 **Complex analysis**, 3rd year, Sorbonne University.  
Supervision of exercises.
- 2014-2015 **Vector calculus**, 2nd year, Sorbonne University.  
Supervision of exercises.
- 2014-2015 **Analysis and algebra**, 1st year, Sorbonne University.  
Supervision of exercises.
- 2009-2010 **Modeling in microbiology**, 3rd year, École SupAgro, INRAE, Montpellier.  
Supervision of exercises and lab works.

## Administration activities

- Since 2022 **In charge of Nplusi pedagogic program for ENSEA.**
- Since 2018 **In charge within the cooperation between ENSEA and ENIS-Tunisia,**  
teaching and research domains.
- 2018-2019 **Elected member of laboratory council,** Quartz.
- Since 2017 **Co-animator of Quartz seminars,** ENSEA.

## Research activities

### Organization of scientific events

- 2022 **Co-organizer** (with Yacine CHITOUR) of the invited session "*Switching systems: an Overview and new developments*", 10th International Conference on Systems and Control (ICSC 2022), Marseille, France.
- 2019 **Co-organizer** (with Jean-Pierre BARBOT) of the invited session "*Time-delay systems: Overview and new developments*", SIAM Conference on Control and Its Applications (CT19), Chengdu, China.
- 2016 **Co-organizer** (with Hélène FRANKOWSKA) of the international workshop "*Decision models and population management*", Sorbonne University, France.

- 2015 **Co-organizer of the international workshop "*Time-delay systems*"**, CentraleSupélec, France.
- 2013 **Co-Chair of the session "*Emerging Control Applications II*"**, ECC13, ETH Zurich, Switzerland.

### Scientific visits

- 2021 **EDST, Lebanese University, Hadath, Lebanon.**  
2 weeks, invited by Prof. Samer ISRAWI.
- 2020 **LS2N, École Centrale de Nantes, France.**  
2 days, invited by Prof. Malek GHANES.
- 2019 **Università degli Studi dell'Aquila, L'Aquila, Italy.**  
2 weeks, invited by Prof. Pierdomenico PEPE.
- 2019 **INRAE-MISTEA, Montpellier, France.**  
2 days, invited by Prof. Alain RAPAPORT.
- 2018 **Università degli Studi dell'Aquila, L'Aquila, Italy.**  
1 month, invited by Prof. Pierdomenico PEPE.
- 2017 **Università degli Studi dell'Aquila, L'Aquila, Italy.**  
10 days, invited by Prof. Pierdomenico PEPE.

### Seminars

- 2022 **Invited talk, INRAE (LBE-MISTEA), Montpellier, France.**  
Title: Observers for batch processes with growth inhibition: a multi-observers approach.
- 2019 **Talk, 58th CDC conference, Nice, France.**  
Title: Converse Lyapunov theorems for infinite-dimensional nonlinear switching systems.
- 2019 **Talk, 58th CDC conference, Nice, France.**  
Title: A multi observers approach when observability index is higher than the state dimension- a case study-.
- 2018 **Talk, GT SYNC-GDR MACS, CNAM, France.**  
Title: Observability singularity of batch reactor: A solution based on high order sliding mode differentiator approach.
- 2017 **Invited talk, MIS seminars of Laboratoire AMPERE, École centrale de Lyon, France.**  
Title: Stability of interconnected uncertain delay systems: a converse Lyapunov approach.
- 2017 **Invited talk, Laboratoire des Signaux et Systèmes (L2S), CentraleSupélec, Gif-sur-Yvette, France.**  
Title: A relaxation result for state constrained delay differential inclusions.
- 2016 **Invited talk, Laboratoire Quartz, ENSEA, Cergy, France.**  
Title: Converse Lyapunov-Krasovskii theorems for uncertain retarded differential equations.
- 2016 **Talk, International workshop on Decision Models and Population Management, Sorbonne University, Paris France.**  
Title: Mathematical modeling of urban pigeon population subject to social management strategies: approach using viability theory.
- 2015 **Talk, Laboratoire des Signaux et Systèmes (L2S), CentraleSupélec, Gif-sur-Yvette, France.**  
Title: Converse Lyapunov-Krasovskii theorems for uncertain retarded differential equations.
- 2015 **Talk, 12th IFAC Workshop on Time Delay Systems, University of Michigan, USA.**  
Title: Further remarks on Markus-Yamabe instability for time-varying delay systems.

- 2014 **Talk**, *19th IFAC World Congress, Cape Town, South Africa*.  
Title: Converse Lyapunov-Krasovskii theorems for uncertain time-delay systems.
- 2013 **Talk**, *GT MOSAR-GDR MACS, CRAN, Nancy, France*.  
Title: Converse Lyapunov-Krasovskii theorems for uncertain retarded differential equations.
- 2013 **Invited talk**, *MODEMIC seminars, MISTEA-INRAE, Montpellier, France*.  
Title: Basal ganglia oscillations: the role of delays and external excitatory nuclei.
- 2013 **Invited talk**, *HYCON2-AD3 on Biological and Medical systems international workshop, ENSCP Paris, France*.  
Title: Generation of pathological basal ganglia oscillations: analysis based on control theory.
- 2013 **Talk**, *ECC13, ETH Zurich, Switzerland*.  
Title: Basal ganglia oscillations: the role of delays and external excitatory nuclei.
- 2012 **Invited talk**, *EDST seminars, Lebanese University, Hadath, Lebanon*.  
Title: Effects of spatial structure and diffusion on the performances of the chemostat.
- 2011 **Talk**, *STIC pour l'environnement national conference, École des MINES, saint-Etienne, France*.  
Title: Effects of spatial structure and diffusion on the performances of the chemostat.
- 2010 **Invited talk**, *TREASURE-INRAE workshop, ENIT, Tunisia*.  
Title: Effects of spatial structure and diffusion on the performances of the chemostat.

### Editorial activity

Since 2012 **Reviewer on a regular basis for journals and conferences**, Automatica, Transactions on Automatic Control, Mathematical Biosciences and Engineering, Systems and Control Letters, SIAM Journal on Control and Optimization, Nonlinear Dynamics, IMA Journal of Mathematical Control and Information, International Journal of Dynamics and Control, International Journal of Control, International Journal of Robust and Nonlinear Control, CDC, ECC, IFAC, NOLCOS....

## Supervision

### Postdoc supervision

- 2022-2023 **Scientific advisor of Manel Dali Youcef** (ATER ENSEA).  
Topic: *Analysis and control of the input-output performances of interconnected chemostats under fluctuating environment conditions*.

### PhD supervision

- 2018-2022 **Co-advisor (60%) of Mariem MAKNI**, with *Jean-Pierre Barbot (30%) and Frank PLESTAN (10%)*.  
Topic: *Modeling, analysis and control of twin wind turbine subject to asymmetric fault*  
Publications: [Makni et al., 2022a,c,b, 2021, 2020]

### M2 supervision

- 2019 **Advisor (100%) of Ghofrane Ben ABDALLAH**, M2 internship, 5 months.  
Topic: *Input-output linearization of nonlinear systems with piecewise-constant delay*

### Other supervisions

- 2020 **Advisor (100%) of a team of two students**, 2nd year ENSEA, Mathematical modeling and analysis of a microbial fuel cells system, 4 months.
- Since 2018 **Academic tutor of graduation projects (2 students per year)**, 3rd year ENSEA.

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## Projects

- 2021 **Coordinator of project funded by SRV mission of ENSEA, (7,45 k€).**  
Publications: [Haidar et al., 2022b, Haidar and Pepe, 2022]
- 2019 **Coordinator of project funded by SRV mission of ENSEA, (5,84 k€).**  
Publications: [Haidar et al., 2022a, Haidar and Pepe, 2021, Haidar et al., 2021a, 2019a]
- 2018 **Coordinator of project funded by SRV mission of ENSEA, (3,8 k€).**  
Publications: [Haidar and Pepe, 2020]

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## Publications

### Journal papers

1. Mariem Makni, [Ihab Haidar](#), Jean-Pierre Barbot and Franc Plestan, *Active Fault-Tolerant Control Based on Sparse Recovery Diagnosis: The Twin Wind Turbines Case*, International Journal of Robust and Nonlinear Control, (accepted), 2022.
2. [Ihab Haidar](#), Elie Desmond-Le Quémener, Jean-Pierre Barbot, Jérôme Harmand and Alain Rapaport, *Modeling and Optimal Control of an Electro-Fermentation Process within a Batch Culture*, 10, 535, Processes 2022,
3. Mariem Makni, [Ihab Haidar](#), Jean-Pierre Barbot, Franc Plestan, Nabih Feki, M. Slim Abbes, *Observer-Based Active Fault-Tolerant Control of an Asymmetric Twin Wind Turbine*, 13, 113, Information 2022.
4. [Ihab Haidar](#), Jean-Pierre Barbot and Alain Rapaport, *A multi-observers approach for a class of bidimensional non-uniformly observable systems*, IEEE Transactions on Automatic Control, 2022.
5. [Ihab Haidar](#), Yacine Chitour, Paolo Mason and Mario Sigalotti, *Lyapunov characterization of uniform exponential stability for nonlinear infinite-dimensional systems*, 67(4), 1685 - 1697, IEEE Transactions on Automatic Control, 2022.
6. [Ihab Haidar](#), Pierdomenico Pepe, *Lyapunov–Krasovskii characterizations of input-to-state stability for switching retarded systems*, 59(4), 2997-3016, SIAM Journal on Control and Optimization (SICON), 2021.
7. [Ihab Haidar](#), Pierdomenico Pepe, *Lyapunov–Krasovskii characterizations of stability notions for switching retarded systems*, IEEE Transactions on Automatic Control, 2020.
8. [Ihab Haidar](#), Florentina Nicolau, Jean-Pierre Barbot and Woihida Aggoune, *Input-output linearization of SISO time-varying delay systems*, IMA Journal of Mathematical Control and Information, pp. 1-24, 2019.
9. Hélène Frankowska and [Ihab Haidar](#), *A relaxation result for state constrained delay differential inclusions*, IEEE Transactions on Automatic Control, vol. 63, no. 11, pp. 3751-3760, Nov. 2018.
10. [Ihab Haidar](#), Isabelle Alvarez and Anne-Caroline Prévot, *Mathematical modeling of urban pigeon population subject to local management strategies*, Journal of Mathematical Biosciences, 288, 71–83, 2017.
11. [Ihab Haidar](#), William Pasillas-Lépine, Antoine Chaillet, Elena Panteley, Stéphane Palfi and Suhan Senova, *A firing-rate regulation strategy for closed-loop deep brain stimulation*, Biological Cybernetics, 110(1), 55–71, 2016.
12. [Ihab Haidar](#), Paolo Mason and Mario Sigalotti, *Converse Lyapunov–Krasovskii theorems for uncertain retarded differential equations*, Automatica, 62, 263-273, 2015.
13. Alain Rapaport, [Ihab Haidar](#) and Jérôme Harmand, *Global dynamics of the buffered chemostat with non-monotonic response functions*, Journal of Mathematical Biology, 7(1), 69–98, 2015.
14. [Ihab Haidar](#), William Pasillas-Lépine, Elena Panteley, Antoine Chaillet, Stéphane Palfi and Suhan Senova, *Analysis of delay-induced basal ganglia oscillations: the role of external excitatory nuclei*, International Journal of Control, 87(9), 1936–1956, 2014.

15. [Ihab Haidar](#), Frédéric Gérard and Alain Rapaport, *Effects of spatial structure and diffusion on the performances of the chemostat*, *Mathematical Biosciences and Engineering*, 8(4), 953–971, 2011.
16. [Ihab Haidar](#), Frédéric Gérard and Alain Rapaport, *Comparison of numerical simulations of reactive transport and chemostat-like models*, *Computational Ecology and Software*, 1(4), 224–239, 2011.

### Patent

17. Alain Rapaport, Jérôme Harmand and [Ihab Haidar](#), *Stabilisation de procédés biotechnologiques présentant une instabilité due à une inhibition par le substrat, par des configurations de type "poche"*, Brevet d'invention n° BNT210061FR00, Février 2012.

### Book chapter

18. [Ihab Haidar](#), Paolo Mason and Mario Sigalotti, *Stability of interconnected uncertain delay systems: a converse Lyapunov approach*, *Delays and Interconnections: Methodology, Algorithms and Applications*, G. Valmorbida and A. Seuret and I. Boussaada and R. Sipahi, Volume 10, Springer, 2019.

### Conference papers

19. [Ihab Haidar](#), Pierdomenico Pepe, *ISS characterization of retarded switching systems with relaxed Lyapunov–Krasovskii functionals*, 61st IEEE Conference on Decision and Control (CDC), 2022.
20. Mariem Makni, [Ihab Haidar](#), Jean-Pierre Barbot, Franc Plestan, Nabih Feki, M. Slim Abbes, *Active fault tolerant control for twin wind turbine subject to asymmetric fault*, International Conference on Control, Automation and Diagnosis (ICCAD), 2021.
21. [Ihab Haidar](#), Jean Pierre Barbot and Alain Rapaport, *Illustration of the application of the multi-observers approach*, 9th International Conference on Systems and Control (ICSC), 2021.
22. Florentina Nicolau, [Ihab Haidar](#), Jean-Pierre Barbot and Woihida Aggoune, *Input-output decoupling and linearization of nonlinear multi-input multi-output time-varying delay systems*, 21st IFAC World Congress, 2020.
23. Mariem Makni, [Ihab Haidar](#), Jean-Pierre Barbot, Franck Plestan, Nabih Feki, Mohamed Slim Abbes, *Analysis and control of Twin Wind Turbine subject to asymmetric fault*, IEEE Conference on Control Technology and Applications (CCTA), 2020.
24. [Ihab Haidar](#), Yacine Chitour, Paolo Mason and Mario Sigalotti, *Converse Lyapunov theorems for infinite-dimensional nonlinear switching systems*, 58th IEEE Conference on Decision and Control (CDC), 2019.
25. [Ihab Haidar](#), Jean-Pierre Barbot and Alain Rapaport, *A multi-observers approach when observability index is higher than the state dimension- a case study*, 58th IEEE Conference on Decision and Control (CDC), 2019.
26. Hélène Frankowska and [Ihab Haidar](#), *Viable trajectories for non-convex differential inclusions with constant delay*, 14th IFAC Workshop on Time Delay Systems, 51(14), 33–38, Budapest, Hungary, June 28–30, 2018.
27. Florentina Nicolau, [Ihab Haidar](#), Jean-Pierre Barbot and Woihida Aggoune, *Input-output decoupling and linearization of nonlinear two-input two-output time-varying delay systems*, 23rd International Symposium on Mathematical Theory of Networks and Systems Hong Kong University of Science and Technology, Hong Kong, July 16–20, 2018.
28. [Ihab Haidar](#), Jean-Pierre Barbot, Alain Rapaport and Malek Ghanes, *Observability singularity of batch bioreactors: a solution based on high order sliding mode differentiator approach*, 11th Asian Control Conference (ASCC), 2017.
29. [Ihab Haidar](#), Florentina Nicolau, Jean-Pierre Barbot and Woihida Aggoune, *Further remarks on Input-output linearization of SISO time-varying delay systems*, SIAM Conference on Control and its Applications 2017.
30. [Ihab Haidar](#), Florentina Nicolau, Jean-Pierre Barbot and Woihida Aggoune, *Input-output linearization of SISO nonlinear time-varying delay systems*, 20th IFAC World Congress 2017.



31. Ihab Haidar, Paolo Mason, Silviu Niculescu, Mario Sigalotti and Antoine Chaillet, *Further remarks on Markus-Yamabe instability for time-varying delay differential equations*, 12th IFAC Workshop on Time Delay Systems, pages 33–38, Ann Arbor, MI, USA, June 2015.
32. Ihab Haidar, Paolo Mason and Mario Sigalotti, *Converse Lyapunov–Krasovskii theorems for uncertain time-delay systems*, The 19th IFAC World Congress, pages 10096-10100, Cape Town, South Africa, Aug. 2014.
33. William Pasillas-Lépine, Ihab Haidar, Antoine Chaillet and Elena Panteley, *Closed-loop Deep Brain Stimulation Based on Firing-rate Regulation*, Neural Engineering (NER), 2013 6th International IEEE/EMBS, pages 166–169, San Diego, USA, Nov. 2013.
34. Ihab Haidar, William Pasillas-Lépine, Elena Panteley and Antoine Chaillet, *Basal ganglia oscillations: the role of delays and external excitatory nuclei*, IEEE European Control Conference (ECC), pages 4083–4088, Zurich, Switzerland, July 2013.
35. Alain Rapaport, Ihab Haidar and Jérôme Harmand, *Global stability of chemostat under growth inhibition with a buffer interconnection*, 9th IFAC Symposium on Nonlinear Control Systems (NOLCOS 2013), Toulouse, France, Sep. 2013.
36. Ihab Haidar and Alain Rapaport, *Effects of spatial structure and diffusion on the performances of the chemostat*, Colloque Sciences et Techniques de l'Information et de la Communication pour l'Environnement 2011, pages 87–100, Saint-Etienne, France, Juin 2011.

#### Submitted papers

37. Yacine Chitour, Ihab Haidar, Paolo Mason and Mario Sigalotti, *Upper and lower bounds for the maximal Lyapunov exponent of singularly perturbed linear switching systems*, 2022.
38. Ihab Haidar, *Non-coercive Lyapunov–Krasovskii functionals for exponential stability of time-varying delay systems: a switched system approach*, 10th International Conference on Systems and Control (ICSC), 2022.
39. Yacine Chitour, Ihab Haidar, Paolo Mason and Mario Sigalotti, *Stability criteria for singularly perturbed linear switching systems*, 10th International Conference on Systems and Control (ICSC), 2022.
40. Mariem Makni, Ihab Haidar, Jean-Pierre Barbot and Franc Plestan, *Active fault tolerant control through sparse recovery diagnosis*, 10th International Conference on Systems and Control (ICSC), 2022.