Alejandro Lancho Serrano

Contact information

Postdoctoral Researcher
Chalmers University of Technology,
Department of Electrical Engineering,
Communication Systems Group,
EDIT building, Hörsalsvägen 9-11, 412 58,
Gothenburg, Sweden

e-mail: lancho@ieee.org
sites.google.com/view/lancho
ORCID: 0000-0003-4211-0454

Education

Universidad Carlos III de Madrid, Leganés, Madrid, Spain

Ph.D., Multimedia and Communications **01/02/2015 – 24/06/2019**

- Supervisor: Prof. Tobias Koch
- Thesis title: *Fundamental limits of short-packet wireless communications* (Available in my personal website)
  The aim was to characterize the maximum coding rate at which data can be transmitted over a point-to-point Rayleigh block-fading channel when the data is transmitted using short packets and subject to a given error probability. From different nonasymptotic bounds on the maximum coding rate as a function of the blocklength and error probability, we obtained different easy-to-compute and mathematically insightful approximations for the aforementioned channel model.

M.S., Multimedia and Communications **12/09/2013 – 13/07/2014**

- Thesis supervisor: Prof. Víctor P. Gil Jiménez
- Thesis Title: *Efficient and robust synchronization and channel estimation in CoMP OFDM systems*
  We designed a method to simultaneously perform timing synchronization and channel estimation for cooperative multi-point transmission and reception OFDM systems.

B.E., Communication Systems Engineering **12/09/2009 – 12/07/2013**

- Thesis Advisor: Prof. Víctor P. Gil Jiménez
- Thesis Title: *Implementación de la señalización de una estación base UMTS*
  We implemented the main functionality of a UMTS base station using USRP software defined radio devices and NI Labview programming.

Professional experience

Chalmers University of Technology, Gothenburg, Sweden

Postoctoral researcher **01/10/2019 – present**

- Supervisor: Prof. Giuseppe Durisi
- The aim of my postdoctoral contract is to apply information theory to study and design secure, private, and low-latency cloud connectivity protocols for IoT applications. My responsibility inside the project is to conduct the research to study the performance of low-latency communications applied to IoT applications and devices.

FPU mobility internship fellow by Ministerio de Educación, Cultura y Deporte (Spain) **01/09/2017 – 01/12/2017**

- Supervisor: Prof. Giuseppe Durisi
- This grant is aimed to financially support PhD students to visit prestigious research centers at an international level, and therby complement their PhD studies. During this research visit, we applied the saddlepoint expansion method to derive accurate approximations of existing nonasymptotic bounds to characterize the area in which the maximum coding rate at which data can be transmitted lies in function of the error probability and the packet length over a Rayleigh block-fading channel. I was responsible of conducting the technical derivations and of evaluating the obtained approximations.

Universidad Carlos III de Madrid, Leganés, Madrid, Spain

UC3M PhD studies **14/07/2014 – 30/09/2019**

- Research assistant (01/02/2019 – 30/09/2019): The purpose of this contract was to finish the last open works we had, which were finally included in my PhD thesis and supposed an important contribution to the ERC project of the supervisor.
- FPU fellow (12/09/2015–31/01/2019): Main funding during the PhD studies. During this period, I performed both research and teaching.

- Predoctoral researcher (01/02/2015–11/09/2015). I was hired by Tobias Koch to start my PhD under his supervision. This contract covered the period of time until the FPU fellowship was resolved.
- Teaching assistant (14/07/2014–31/01/2015): Extension of the Master Grant to perform teaching at the Signal Theory and Communications Department and to state my PhD plan.

Unitronics S.A., San Sebastián, Madrid, Spain

Scholarship **29/02/2013 – 29/06/2013**

- I was involved in the Communication Architecture Department. My main task was to design (or redesign) the telecommunication infrastructure, both wired and wireless, of company buildings.

Publications

Preprints

[P1] J. Östman, A. Lancho, G. Durisi and L. Sanguinetti, "URLLC with Massive MIMO: Analysis and Design at Finite Blocklength", arXiv:2009.10550 [cs.IT], Sep. 2020.

Journal Publications

[J1] A. Lancho, J. Östman, G. Durisi, T. Koch and G. Vazquez-Vilar, "Saddlepoint approximations for short-packet wireless communications", IEEE Trans. Wireless Commun., vol. 19, no. 7, pp. 4831-4846, Jul. 2020.

[J2] A. Lancho, T. Koch, and G. Durisi, "On single-antenna Rayleigh block-fading channels at finite blocklength," IEEE Trans. Inf. Theory, vol. 66, no. 1, pp. 496-519, Jan. 2020.

[J3] V. P. Gil Jiménez, A. Lancho Serrano, B. Genovés Guzmán and A. García Armada, "Learning mobile communications standards through flexible software defined radio base stations", IEEE Commun. Mag. vol. 55, no. 6, pp. 116-123, May 2017.

[J4] B. Genovés Guzmán, A. Lancho Serrano and V. P. Gil Jiménez , "Cooperative optical wireless transmission for improving performance in indoor scenarios for visible light communications", IEEE Trans. Consum. Electron. vol. 61, no. 4, pp. 393-401, Nov. 2015.

Conference Publications

[C1] A. Lancho, J. Östman, T. Koch and G. Vazquez-Vilar , "Finite-blocklength approximations for noncoherent Rayleigh block-fading channels", in Proc. Asilomar Conf. Signals, Syst., Comput., Pacific Grove, CA, USA, Nov. 2019. **Invited paper**

[C2] J. Östman, A. Lancho and G. Durisi, "Short-packet transmission over a bidirectional massive MIMO link", in Proc. Asilomar Conf. Signals, Syst., Comput., Pacific Grove, CA, USA, Nov. 2019. **Invited paper**

[C3] A. Lancho, J. Östman, G. Durisi, T. Koch and G. Vazquez-Vilar, "Saddlepoint approximations for Rayleigh block-fading channels", in Proc. IEEE Int. Symp. Inf. Theory (ISIT), Paris, France, Jul. 2019.

[C4] G. Vazquez-Vilar, A. Guillén i Fàbregas, T. Koch and A. Lancho. "Saddlepoint approximation of the error probability of binary hypothesis testing", in Proc. IEEE Int. Symp. Inf. Theory (ISIT). Vail, USA, Jun. 17-22, 2018.

[C5] A. Lancho, T. Koch and G. Durisi. "Normal approximations for fading channels", in Proc. 52nd Annual Conf. Inf. Sci. and Syst., Princeton, NJ, Mar. 21-23, 2018. **Invited paper**

[C6] J. Font-Segura, G. Vazquez-Vilar, A. Martinez, A. Guillén i Fàbregas and A. Lancho. "Saddlepoint approximations of lower and upper bounds to the error probability in channel coding", in Proc. 52nd Annual Conf. Inf. Sci. and Syst., Princeton, NJ, Mar. 21-23, 2018. **Invited paper**

[C7] A. Lancho, T. Koch and G. Durisi. "A high-SNR Normal approximation for single-antenna Rayleigh block-fading channels", in Proc. IEEE Int. Symp. Inf. Theory (ISIT), Aachen, Germany, Jun. 2017. **Finalist IEEE Jack Keil Wolf ISIT Student Paper Award**

[C8] A. Lancho Serrano and V. P. Gil Jiménez "Sincronización y estimación de canal eficiente y robusta en sistemas CoMP OFDM", XXIX Simposium Nacional de la Unión Científica Internacional de Radio, Valencia, Spain, Sep. 2014.

Invited Talks

[T1] A. Lancho. "Finite-blocklength approximations for noncoherent Rayleigh block-fading channels", Asilomar Conf. Signals, Syst., Comput., Pacific Grove, CA, USA, Nov. 2019.

[T2] A. Lancho. "Normal Approximations for Fading Channels", 52nd Annual Conf. Inf. Sci. and Syst., Princeton, NJ, Mar. 21-23, 2018.

Organization of International Events

- Volunteer (technical session assistant) at the IEEE International Symposium on Information Theory, Barcelona, Spain, Jul. 2016.
- Collaboration in the organization of the European School of Information Theory, Madrid, Spain, May 2017. With other two PhD students, we were in charge of the registration and reception of the around 70 attendants.

Honors and awards

- Ph.D. thesis with grade: Excellence (*cum laude*)
- Finalist Jack Keil Wolf Student Paper Award at the 2017 IEEE Int. Symp. Inf. Theory
- National Thesis Award (undergraduate level): Ranked third overall Spanish students graduated in Communications Engineering degrees.
- Spanish Repsol Inspire program. Overcome the first stage (Awarded €2000). Only 10 research proposal were selected in the first stage over all the applications at the UC3M.
- M.Sc thesis with grade: 10/10
- B.Sc thesis with grade: 10/10 (distinction)
- B.Sc achieving rank 2 with grade 9/10. Average grade of the graduated students of the class: 6.71/10
- Excellence award. Best 20 students at Universidad Carlos III de Madrid (2012)
- Excellence grant (Madrid, 2010 and 2012)
- Excellence certification (Madrid, 2009)

Grants and fellowships

FPU research visit grant **01/09/2017 – 01/12/2017**

- Competitive grant by the Ministerio de Educación, Cultura y Deporte to fund short visits of fellows belonging to the FPU program

UC3M research visit grant **01/09/2017 – 01/12/2017**

- Competitive grant by the Universidad Carlos III de Madrid to fund short visits of Ph.D. students

FPU fellowship **12/09/2015 – 31/01/2019**

- Competitive grant by the Ministerio de Educación, Cultura y Deporte
- Most prestigious fellowship for Ph.D. studies in Spain
- Ranked first inside the telecommunications area

Master Grant **01/09/2013 - 31/01/2015**

- Competitive grant by the Universidad Carlos III de Madrid
- Research and teaching duties at the Signal Theory and Communications Department

Undergraduate Collaboration Grant **01/12/2012 – 01/06/2013**

- Competitive grant by the Ministerio de Educación, Cultura y Deporte
- Involved in the Communications group at the Universidad Carlos III de Madrid
- Implementation of the main functionality of a UMTS base station using USRP nodes
  - This work was presented as the B.Sc. thesis

Madrid Excellence Grant **01/02/2010 – 01/05/2010**

- 50 hours with Prof. Elena Romera at the Mathematics Department in the Universidad Carlos III de Madrid
- Course on complex variables and transforms theory

University preparation activities **30/06/2008 – 04/07/2008**

- Competitive grant for the best high-school students in Madrid
- I programmed the basic functionalities of a robot at the Universidad Autónoma de Madrid

Teaching Experience

Universidad Carlos III de Madrid, Leganés, Madrid

- Communication Theory laboratory (undergraduate level, around 20 students, 40 hours) **2017/18**
- Digital Communications (undergraduate level, around 30 students, 18 hours) **2016/17**
- Communication Theory laboratory (undergraduate level, around 20 students, 25 hours) **2016/17**
- Access Network Technologies laboratory (undergraduate level, around 20 students, 10 hours) **2014/15**
- Communication Channels and Systems laboratory (undergraduate level, around 20 students, 20 hours) **2014/15**

- Digital Communications Overview (undergraduate level, around 10 students, 7.5 hours) **2014/15**
- Communication Theory laboratory (undergraduate level, around 20 students, 10 hours) **2013/14**
- Mobile Communications laboratory (undergraduate level, around 20 students, 30 hours) **2013/14**

Participation in Research Projects

Secure, Private, and Low-Latency Cloud Connectivity for IoT Applications

Wallenberg AI, Autonomous Systems and Software Program (WASP) Expedition Project (Sweden) **2019 – 2021**

- Role: team member. This project seeks the fundamental limits and design of secure, private, and low-latency cloud connectivity protocols for IoT applications. I am in charge of studying the limits in terms of latency of secure and private protocols, and of designing the communication protocol working close to the fundamental limits.
- Principal investigators: Giuseppe Durisi and Aikaterini Mitrokotsa (Chalmers University of Technology)

Information Theory for Low-Latency Wireless Communications (LOLITA)

European Research Council (ERC) Starting Grant **2017 – 2019**

- Role: team member. My entire thesis was aligned with some objectives of this ERC grant. Hence, the journal publications [J1] and [J2], which aims to characterize the fundamental limits of low-latency communications and to evaluate these limits accurately and efficiently, contributed to this project.
- Principal investigator: Tobias Koch (UC3M)

Finite-length iterative decoding: fundamental limits, practical constructions and inference (FLUID)

Proyecto I+D+i Retos Investigación, Spanish Ministry of Economy & Competitiveness and Spanish National Research Agency **2016 – 2018**

- Role: project member. My role in this project consisted in studying the fundamental limits of practical decoding schemes when there are stringent code-length constraints.
- Principal investigator: Gonzalo Vázquez-Vilar and Pablo M. Olmos (UC3M)

Overhead-Throughput-Optimal Signaling Schemes for Next-Generation Wireless Networks (OTOSiS)

Proyecto I+D+i Retos Investigación, Spanish Ministry of Economy & Competitiveness **2014 – 2016**

- Role: team member. This project supported my PhD studies from the very beginning and all the publications included in my PhD thesis about the fundamental limits of short-packet wireless communication systems contributed to different aspects of this project.
- Principal investigator: Tobias Koch (UC3M)

General radio concepts for energy cognizant mobile communication systems (GREENSYST)

Plan Nacional de I+D+i, Spanish Ministry of Science & Innovation **2012 – 2014**

- Role: team member. I contributed to this project with the journal publication [J4], which proposes a cooperative scheme to use visible light communications in a efficient way.
- Principal investigator: Víctor P. Gil Jímenez (UC3M)

Other skills

Languages: Spanish (native), English (fluent)

Programming: Matlab, Python, NI Labview