Francesco Smarra, Ph.D.

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Employment History

Current position

2019 – ····   🔖 **Assistant professor at Università degli Studi dell'Aquila**
Department of Information Engineering, Computer Science and Mathematics
Period: 02/05/2019 - on-going
Research activity on Energy efficiency, Building Automation Systems, Machine learning and control, Control systems, Structural Health Monitoring, Software Defined Networks, Network Coding, Wireless Networked Control Systems.
Class taught: *Laboratorio di ingegneria e tecnologia dei sistemi di controllo*, 30 hours. Held during the Academic Years 2020-2021, 2021-2022, 2022-2023;
Class taught: *Laboratory of automatic systems*, 30 hours. Held during the Academic Years 2019-2020, 2020-2021, 2021-2022, 2022-2023;
Class taught: *Modelling and control of communication cetworks*, 30/90 hours. Held during the Academic Year 2019-2020, jointly with Prof. Alessandro D'Innocenzo.

Previous positions

2015 – 2019   🔖 **Postdoctoral researcher at Università degli Studi dell'Aquila**
Department of Information Engineering, Computer Science and Mathematics
Supervisor: Dr. Alessandro D'Innocenzo
Research activity: *Energy efficiency, Building Automation Systems, Machine learning and control, Control systems, Network Coding, Wireless Networked Control Systems*
Period: 01/07/2015 - 01/05/2019

2016 – 2019   🔖 **Lecturer at Università degli Studi dell'Aquila**
Department of Information Engineering, Computer Science and Mathematics
Class name: *Laboratorio di automatica* (in Italian), 30 hours. Held during the Academic Years 2015-2016, 2016-2017, 2017-2018
Class name: *Laboratory of automatic systems*, 30 hours. Held during the Academic Year 2018-2019;
Class name: *Fundamentals of Machine Learning over Networks and Applications to control of Cyber Physical Systems* (series of seminars), 10/30 hours. Held during the Academic Year 2018-2019, jointly with Dr. Alessandro D'Innocenzo and Prof. Carlo Fischione.

2016 – 2017   🔖 **Research scholar at University of Pennsylvania**
Department of Electrical and Systems Engineering
Supervisor: Prof. Rahul Mangharam
Research activity: *focus on bridging Machine Learning and control theory, with application on energy efficiency in Smart Buildings*
Founded by Prof. Rahul Mangharam
Periods: 01/09/2016 - 24/02/2017, 24/08/2017 - 20/12/2017

Employment History (continued)

2014 – 2015   **Visiting scholar at University of Pennsylvania**
Department of Electrical and Systems Engineering
Advisors: Prof. George Pappas, Prof. Rahul Mangharam
Research activity: *Wireless Networked Control Systems and energy efficiency in Smart Buildings*
Founded with a scholarship awarded by Fondazione F. Filauro
Period: 03/09/2014 – 02/03/2015

2011 – 2016   **Teaching assistant at Università degli Studi dell'Aquila**
Department of Information Engineering, Computer Science and Mathematics, and Department of Electrical and Information Engineering
Class name: *Controlli automatici (Automatic control)*. Held by Prof. Maria Domenica Di Benedetto during the Academic Years 2011-2012, 2013-2014, 2015-2016
Class name: *Analisi e controllo di sistemi ibridi (Analysis and control of hybrid systems)*. Held by Prof. Maria Domenica Di Benedetto during the Academic Years 2011-2012, 2015-2016
Class name: *Ingegneria e tecnologia dei sistemi di controllo (Engineering and technology of control systems)*. Held by Dr. Alessandro D'Innocenzo during the Academic Year 2012-2013
Class name: *Modeling and control of communication networks* (taught in english). Held by Dr. Alessandro D'Innocenzo during the Academic Years 2015-2016, 2017-2018
Class name: *Control systems* (taught in english). Held by Dr. Alessandro D'Innocenzo during the Academic Year 2015-2016

Education

2010 – 2014   **Ph.D. in Electrical and Information Engineering at Università degli Studi dell'Aquila**
Thesis title: *Fault Tolerant Control of Multi-hop Networked Control Systems*
Advisor: Prof. Maria Domenica Di Benedetto; Co-Advisor: Dr. Alessandro D'Innocenzo
Period: 16/12/2010 – 16/04/2014

2012 – 2013   **Visiting Ph.D. student at University of California at Berkeley**
MPC Lab, Department of Mechanical Engineering
Advisors: Prof. Francesco Borrelli, Prof. Alberto Sangiovanni Vincentelli
Research activity: *energy efficiency in Smart Buildings*
Funded with a scholarship awarded by Fondazione "Giuliana Tamburro – Onlus" ENAC
Period: 20/08/2012 – 19/02/2013

2010   **M.Sc. thesis preparation at University of Glasgow**
James Watt School of Engineering
Advisors: Dr. Bernd Porr, Dr. Paolo Di Prodi
Period: 01/07/2010 – 01/09/2010

2008 – 2010   **M.Sc. (cum Laude) in Control Engineering at Università degli Studi dell'Aquila**
Thesis title: *Controllo del robot bipede RunBot e tecniche di rilevamento della camminata umana per applicazioni ad esoscheletri (RunBot biped robot control, and detection techniques of human walking for exoskeleton applications)*
Thesis developed at the University of Glasgow
Advisor: Prof. Costanzo Manes; Co-advisor: Dr. Paolo Di Prodi
Period: 15/09/2008 – 01/10/2010

2005 – 2008   **B.Sc. in Control Engineering at Università degli Studi dell'Aquila**
Thesis title: *Analisi dei motivi ricorrenti nelle reti di trascrizione genica (Analysis of recurrent patterns in transcription gene netowrks)*
Advisor: Prof. Pasquale Palumbo
Period: 16/09/2005 – 24/07/2008

Skills

Languages 🔖 Strong reading, writing and speaking competencies for English; basics of French; mother tongue Italian

Coding 🔖 Matlab, Python, c++

Misc. 🔖 LaTeX, git, dropbox, drive, etc.

Achievements

Awards

2015 🔖 **Best Application Paper Award at ECC15**
14th annual European Control Conference, Linz, Austria, 15-17 July 2015

2013 🔖 **Fondazione "Ferdinando Filauro" scholarship**
Awarded by: Fondazione "F. Filauro" at Università degli Studi dell'Aquila, to spend a 6 months research period at University of Pennsylvania
Amount: €15000

2011 🔖 **Fondazione "Giuliana Tamburro – Onlus" ENAC scholarship**
Awarded by: Fondazione "Giuliana Tamburro – Onlus" ENAC (Ente Nazionale per l'Aviazion Civile - National Authority for Civil Aviation), to spend a 6 months research period at University of California at Berkeley
Amount: €8000

Certifications

2014 🔖 **International Curriculum Option of Doctoral Studies in Networked, Embedded, and Hybrid Control Systems for Complex Distributed Heterogeneous Systems**
Released by: *European Embedded Control Institute*
Period: 16/12/2010 – 16/04/2014

Projects

2021 – 2025 🔖 **SICURA - caSa Intelligente delle teCnologie per la sicURezza - L'Aquila**
Position: ***Researcher***
Web: https://www.ctesicuralaquila.it/

2020 – 2022 🔖 **VALU3S - Verification and Validation of Automated Systems' Safety and Security**
Position: ***Scientific coordinator*** for the Università degli Studi dell'Aquila
Call: H2020-ECSEL-2019-2-RIA
Web: https://valu3s.eu/

🔖 **iRel 40 - Intelligent Reliability 4.0**
Position: ***Researcher and coordinator*** of the research line concerning data-driven methodologies for identification and control at Università degli Studi dell'Aquila
Call: H2020-ECSEL-2019-1-IA
Web: https://www.irel40.eu/

2017 – 2020 🔖 **AQUAS - Aggregated Quality Assurance for Systems**
Position: ***Researcher***
Web: https://aquas-project.eu/

Projects (continued)

2015 – 2021   ◾ **INCIPICT, Innovating City Planning through Information & Communications Technology**
Position: ***Researcher and coordinator*** of the research line concerning data-driven modeling and control for enercy efficiency in Building Automation Systems
Founder: Italian Government under Cipe resolution n.135 (Dec. 21, 2012)
Web: http://incipict.univaq.it/

2012 – 2015   ◾ **RIDITT Ricostruire**
Transfer of technology and creation of new business companies in the field ofadvanced ICT technologies applied to post-earthquake economic and territorial development
Position: ***Researcher***
Web: http://www.sapienzainnovazione.it/progetti/nazionali/riditt-ricostruire.html

2010 – 2014   ◾ **HYCON2 - Highly-complex and networked control systems, Network of excellence**
Position: ***Researcher***
Call: FP7-ICT-2009-5
Web: http://www.hycon2.eu/

Editorial activity

Editor   ◾ **Associate editor** for the 19th European Control Conference (ECC'21)
Co-organizer of the invited session "Data-driven methods for hybrid systems" at the 7th IFAC Conference on Analysis and Design of Hybrid Systems (ADHS'21)
Associate editor for the 20th European Control Conference(ECC'22)
Associate editor for the 21th European Control Conference(ECC'23)

Chair   ◾ **Session chair** for the invited session "Data-driven methods for hybrid systems" at the 7th IFAC Conference on Analysis and Design of Hybrid Systems (ADHS'21)

Reviewer   ◾ **Reviewer for international journals in control, energy, machine learning and other fields**
IEEE Transactions on Automatic Control, Automatica, International Journal of Robust and Nonlinear Control, Applied Energy, Energy&Buildings, IEEE Transactions on Neural Networks and Learning Systems, IEEE Internet of Things Journal, IEEE Access, International Journal of Adaptive Control and Signal Processing, Energy&Environment, Algorithms, Security Communication Networks

◾ **Reviewer for international conferences in control**
IEEE CDC, HSCC, ECC, IFAC, NecSys, CASE, MED

Tutoring

2019 – 2023   ◾ **Co-tutor of the Ph.D. student Luis Felipe Florenzan Reyes**

Selected talks

Sep. 2020   ◾ **SIDRA annual meeting**
Title: *Learning and control of smart cities via Regression Trees*
Place: Università degli Studi di Cagliari - Virtual edition due to COVID19

Jun. 2019   ◾ **Welcome talk for the Assistant professorship**
Title: *Data-driven Switching Modeling for MPC via Regression Trees and Random Forests*
Place: Department of Information Engineering, Computer Science and Mathematics at Università degli Studi dell'Aquila

Selected talks (continued)

Oct. 2014   🔖 **Welcome talk**
Title: *Fault tolerant control of Multi-hop Networked Control Systems*
Place: Department of Electrical and Systems Engineering at Universiy of Pennsylvania

Sep. 2014   🔖 **SIDRA annual meeting**
Title: *Fault tolerant control of Multi-hop Networked Control Systems*
Place: Università degli Studi di Bergamo

Mar. 2014   🔖 **Job interview at UTRC**
Title: *Control of wireless Multi-hop Control Networks and HVAC systems*
Place: UTRC, Cork, Ireland

Feb. 2014   🔖 **Job interview at ALES-UTC**
Title: *Presentazione Attività (Activities presentation)*
Place: ALES, Rome, Italy

Feb. 2013   🔖 **Farewell talk**
Title: *Hybrid/Switching model for HVAC systems*
Place: Department of Mechanical Engineering at University of California at Berkeley

Publications

Bibliography

1   De Iuliis, V., Smarra, F., Manes, C. & D'Innocenzo, A. (2022). Stability analysis of switched arx models and application to learning with guarantees. *Nonlinear Analysis: Hybrid Systems*, *46*, 101250.

2   Florenzan Reyes, L. F., Smarra, F. & D'Innocenzo, A. (2022). Reduced sarx modeling and control via regression trees. *2022 American Control Conference (ACC)*.

3   Florenzan Reyes, L. F., Smarra, F., Ryf, R., Hayashi, T., Marotta, A., Antonelli, C. & D'Innocenzo, A. (2022). Data-driven efficient digital signal processing over a field trial space-division multiplexed fiber-optic transmission. *2022 International Conference on Computer Communications and Networks (ICCCN)*.

4   Reticcioli, E., Di Girolamo, G. D., Smarra, F., Torzi, A., Graziosi, F. & D'Innocenzo, A. (2022). Modeling and control of priority queueing in software defined networks via machine learning. *IEEE Access*, *10*, 91481–91496.

5   Smarra, F., Tjen, J. & D'Innocenzo, A. (2022). Learning methods for structural damage detection via entropy-based sensors selection. *International Journal of Robust and Nonlinear Control*, *32*(10), 6035–6067.

6   De Iuliis, V., Di Girolamo, G. D., Smarra, F. & D'Innocenzo, A. (2021). A comparison of classical identification and learning-based techniques for cyber-physical systems. *29th Mediterranean Conference on Control and Automation (MED)*, 179–185.

7   De Iuliis, V., Smarra, F., Manes, C. & D'Innocenzo, A. (2021). On the stability of switched arx models, with an application to learning via regression trees. *7th IFAC Conference on Analysis and Design of Hybrid Systems ADHS'21*, *54*(5), 61–66.

8   De Rubeis, T., Smarra, F., Gentile, N., D'innocenzo, A., Ambrosini, D. & Paoletti, D. (2021). Learning lighting models for optimal control of lighting system via experimental and numerical approach. *Science and Technology for the Built Environment*, *27*(8), 1018–1030.

9   Florenzan Reyes, L. F., Smarra, F., Yuriy, Z. L. & D'Innocenzo, A. (2021). Learning markov models of fading channels in wireless control networks: A regression trees based approach. *29th Mediterranean Conference on Control and Automation (MED)*.

10 Cinque, E., Valentini, F., Smarra, F., Franchi, F., D'Innocenzo, A. & Pratesi, M. (2020). A hardware-in-the-loop framework for urban mobility scenarios within the 5g trial in l'aquila. *33rd General Assembly and Scientific Symposium of the International Union of Radio Science (URSI GASS)*.

11 Di Girolamo, G. D., Smarra, F., Gattulli, V., Potenza, F., Graziosi, F. & D'Innocenzo, A. (2020). Data-driven optimal predictive control of seismic induced vibrations in frame structures. *Structural Control and Health Monitoring*, *27*(4), e2514.

12 Jain, A., Smarra, F., Reticcioli, E., D'Innocenzo, A. & Morari, M. (2020). Neuropt: Neural network based optimization for building energy management and climate control. *2nd Annual Conference on Learning for Dynamics and Control (L4DC'20)*.

13 Masti, D., Smarra, F., D'Innocenzo, A. & Bemporad, A. (2020). Learning affine predictors for mpc of non-linear systems via artificial neural networks. *21th World Congress of the International Federation of Automatic Control (IFAC'20)*.

14 Reticcioli, E., Di Girolamo, G. D., Smarra, F., Carmenini, A., D'Innocenzo, A. & Graziosi, F. (2020). Learning sdn traffic flow accurate models to enable queue bandwidth dynamic optimization. *European Conference on Networks and Communications (EuCNC)*, 231–235.

15 Smarra, F., Di Girolamo, G. D., De Iuliis, V., Jain, A., Mangharam, R. & D'Innocenzo, A. (2020). Data-driven switching modeling for mpc using regression trees and random forests. *Nonlinear Analysis: Hybrid Systems*, *36*, 100882.

16 Smarra, F., Di Girolamo, G. D., Gattulli, V., Graziosi, F. & D'Innocenzo, A. (2020). Learning models for seismic-induced vibrations optimal control in structures via random forests. *Journal of Optimization Theory and Applications*, *187*(3), 855–874.

17 Smarra, F. & D'Innocenzo, A. (2020). Learning markov jump affine systems via regression trees for mpc. *21th World Congress of the International Federation of Automatic Control (IFAC'20)*.

18 Tjen, J., Smarra, F. & D'Innocenzo, A. (2020). An entropy-based sensor selection algorithm for structural damage detection. *IEEE 16th International Conference on Automation Science and Engineering (CASE)*, 1566–1571.

19 de Rubeis, T., Gentile, N., Smarra, F., D'Innocenzo, A., Ambrosini, D. & Paoletti, D. (2019). A novel method for daylight harvesting optimization based on lighting simulation and data-driven optimal control. *Proceedings of the 16th IBPSA Conference Building Simulation (BS'19)*, 1036–1043.

20 Lun, Y. Z., D'Innocenzo, A., Smarra, F., Malavolta, I. & Di Benedetto, M. D. (2019). State of the art of cyber-physical systems security: An automatic control perspective. *Journal of Systems and Software*, *149*, 174–216.

21 Jain, A., Smarra, F., Behl, M. & Mangharam, R. (2018). Data-driven model predictive control with regression trees—an application to building energy management. *ACM Transactions on Cyber-Physical Systems*, *2*(1), 1–21.

22 Smarra, F., Di Benedetto, M. D. & D'Innocenzo, A. (2018). Efficient routing redundancy design over lossy networks. *International Journal of Robust and Nonlinear Control*, *28*(6), 2574–2597.

23 Smarra, F., Jain, A., De Rubeis, T., Ambrosini, D., D'Innocenzo, A. & Mangharam, R. (2018). Data-driven model predictive control using random forests for building energy optimization and climate control. *Applied energy*, *226*, 1252–1272.

24 Smarra, F., Jain, A., Mangharam, R. & D'Innocenzo, A. (2018). Data-driven switched affine modeling for model predictive control. *IFAC Conference on Analysis and Design of Hybrid Systems (ADHS'18)*, 199–204.

25 Jain, A., Smarra, F. & Mangharam, R. (2017). Data predictive control using regression trees and ensemble learning. *2017 IEEE 56th Annual Conference on Decision and Control (CDC)*, 4446–4451.

26 Smarra, F., Di Benedetto, M. D. & D'Innocenzo, A. (2017). A sub-optimal method for routing redundancy design over lossy networks. *20th World Congress of the International Federation of Automatic Control (IFAC'17), 1*(50), 2549–2554.

27 Behl, M., Smarra, F. & Mangharam, R. (2016). Dr-advisor: A data-driven demand response recommender system. *Applied Energy, 170*, 30–46.

28 D'Innocenzo, A., Smarra, F. & Di Benedetto, M. D. (2016). Resilient stabilization of multi-hop control networks subject to malicious attacks. *Automatica, 71*, 1–9.

29 D'Innocenzo, A., Smarra, F. & Di Benedetto, M. D. (2015). Further results on fault detection and isolation of malicious nodes in multi-hop control networks. *2015 European Control Conference (ECC)*, 1860–1865.

30 Smarra, F., D'Innocenzo, A. & Di Benedetto, M. D. (2015). Approximation methods for optimal network coding in a multi-hop control network with packet losses. *2015 European Control Conference (ECC)*, 1962–1967.

31 Di Benedetto, M. D., D'Innocenzo, A. & Smarra, F. (2014). Fault-tolerant control of a wireless hvac control system. *2014 6th International Symposium on Communications, Control and Signal Processing (ISCCSP)*, 235–238.

32 D'Innocenzo, A., Smarra, F. & Di Benedetto, M. D. (2013). Fault detection and isolation of malicious nodes in mimo multi-hop control networks. *2013 IEEE 52st IEEE Conference on Decision and Control (CDC)*, 5276–5281.

33 Smarra, F., D'Innocenzo, A. & Di Benedetto, M. D. (2012a). Fault tolerant stabilizability of mimo multi-hop control networks. *IFAC Proceedings Volumes, 45*(26), 79–84.

34 Smarra, F., D'Innocenzo, A. & Di Benedetto, M. D. (2012b). Optimal co-design of control, scheduling and routing in multi-hop control networks. *2012 IEEE 51st IEEE Conference on Decision and Control (CDC)*, 1960–1965.