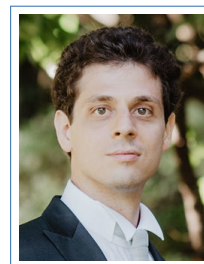


Marco Forgione

Via Piave 3
21100 Varese, Italy
☎ +39 3453371092
✉ marco.forgione@idsia.ch
🌐 www.marcoforgione.it
Born in Varese (Italy) on 6/7/1986



Areas of Expertise

- Systems & Control** Modeling, simulation, and control of complex dynamical systems. System identification, signal processing, optimization.
- Machine learning** Supervised and unsupervised machine learning techniques. Bayesian Optimization, Gaussian Processes, Deep Learning.
- Computer Engineering** Advanced use of numerical and statistical software packages. Good programming and server administration skills.

Current position

2018-now **Researcher**, *Dalle Molle Institute for Artificial Intelligence (IDSIA) USI-SUPSI*, Lugano, Switzerland

My research interests lie at the intersection between Machine Learning, Dynamical Systems, and Control Theory. In particular, I am active in the areas of:

- Physics-informed machine learning for dynamical systems modeling.
- Bayesian optimization for data-driven control design.

I am lecturer of the courses:

- *Data challenge: Annual practical project in applied data science* for the SUPSI Bachelor of Science in Data Science and Artificial Intelligence.
- *Bayesian Data Analysis and Probabilistic Programming* for the SUPSI Bachelor of Science in Data Science and Artificial Intelligence.
- *Big Data analytics and Machine Learning* for the SUPSI Certificate of Advanced Studies Fintech.

Previous Positions

2017-2018 **Software Engineer**, *SMS Spinnler Fleury AG*, Balerna, Switzerland
SMS Spinnler Fleury AG develops and builds industrial micro-assembly machines.

My main tasks were:

- Python scripting for automatic code generation and versioning.
- Programmable Logic Controller (PLC) software development in IEC 61131-3 language.
- Human-Machine Interface (HMI) development in Labview.
- After-sales customer support.

2015-2017 **Control Engineering Consultant**, *Whirlpool EMEA*, Biandronno (VA), Italy

I took part in several R&D projects within the Advanced Development group of Whirlpool. In particular, I was engaged in the following activities:

- Development of temperature estimation and control algorithms for induction cooktops.
- Development of doneness estimation algorithms through humidity measurements.
- Modeling and control of half-bridge and quasi-resonant power converters.
- Implementation of an hardware-in-the-loop software platform for real-time algorithm testing.

I made extensive use of the Matlab, Python, and C programming languages for algorithm development, data visualization and signal processing. Furthermore, I employed statistical methodologies and software in order to plan and analyze the validation experiments required to demonstrate the robustness of my algorithms with respect to different nuisance factors.

2014 – 2015 **Postdoctoral researcher**, *Ecole Centrale de Lyon*, France

I pursued my research in collaboration with the CEA institute of Grenoble on the development of novel control architectures for phase-locked loop circuits with applications to wireless telecommunications. Furthermore, I was teaching assistant for the courses “Signal processing” and “Analog to digital converters”.

Education

2010 – 2014 **PhD in Systems and Control**, *Delft University of Technology*, The Netherlands

Thesis title: *Batch-to-batch learning for model-based control of process systems with application to cooling crystallization*.

2007 – 2009 **MSc in Computer Engineering**, *Università degli Studi di Pavia*

Final grade: **110/110 cum laude**.

Average grade: **29.6/30**.

Thesis title: *Artificial Pancreas: black-box identification of the glucose-insulin metabolisms*.

2004 – 2007 **BSc in Computer Engineering**, *Università degli Studi di Pavia*

Final grade: **110/110 cum laude**.

Average grade: **29.4/30**.

Thesis title: *Design, realization and control of a laboratory-scale gantry crane*.

Academic Experience

Scientific output

- Co-author of about 30 peer-reviewed journal and conference papers.
- Reviewer of about 50 papers submitted to journals and conferences in the Systems & Control and Machine Learning fields.
- Guest editor for the 2022 CIRP CMS conference.
- Organizer (with Dr. D. Piga and Prof. S. Formentin) of the invited session “Linear identification and control for nonlinear systems” at the 2021 SYSID conference.
- Member of the IEEE-CSS Technical Committee on System Identification and Adaptive Control since 2020.
- Plenary session speaker at the 2013 European Network on System Identification. Seminar title: “Iterative model improvement for model-based control”

Research funds acquired in competitive calls

- HIRA: Hybrid InfraRed System for Affective Computing. Eureka Eurostars project. Local coordinator & co-applicant. January 2022 - July 2022. Local SUPSI funding: 275'000 EUR. Total funding: 755'000.
- PRAESIIDIUM: Physics-informed machine learning-based prediction and reversion of impaired fasting glucose management. EU Horizon Europe (HORIZON-RIA) project. Co-applicant (with Laura Azzimonti) for SUPSI. January 2023 - January 2027. Local SUPSI budget: 658'438 EUR. Total Budget: 6'467'179 EUR.
- DEALING: DEep learning for dynamicAL systems and dynamical systems for deep learnING. Funded by HASLER STIFTUNG. Project coordinator & principal investigator. January 2022 - July 2022. Budget: 49'555.80 CHF.

Participation to funded research projects

- EU H2020 project ADMITTED. From February 2019 until now.
- Innosuisse ARTISTIC. From September 2020 until now.
- EU H2020 project DAEDALUS. From January 2019 to September 2019.
- EU FP7 project AUTOPROFIT. From March 2014 to June 2014.
- ISPT PH-00-04: Intelligent Observer and Control for Pharmaceutical Batch Crystallization. From March 2010 to February 2014.
- JDRF Artificial Pancreas Project. From February 2009 to September 2009.

Teaching activities:

At SUPSI:

- *Bayesian Data Analysis and Probabilistic Programming*, 14 hours of lab sessions in 2022 (in English)
- *Data challenge: Annual practical project in applied data science*, 26 hours of lectures/exercise sessions in 2021 and 2022 (in English)
- *Big Data analytics and Machine Learning*, 36 hours of lectures/exercise sessions in 2021 (in Italian)

At the Ecole Centrale de Lyon:

- *Signal Processing*, 42 hours of exercise sessions in 2015 (in French)
- *Signal Processing*, 28 hours of laboratory sessions in 2015 (in French)
- *Analog/Digital Converters*, 18 hours of laboratory sessions in 2015 (in French)

At the Delft University of Technology:

- *Process Control*, 2 hours of laboratory sessions in 2011 (in English)
- *Control System Design*, 8 hours of exercise sessions in 2012 (in English)
- *System Identification*, 4 hours of laboratory sessions in 2014 (in English)

MSc theses: I supervised two MSc students at the Delft University of Technology.

Professional Skills

Control design: Design of PID, H_∞ , MPC, and ILC control algorithms.

Control implementation: MATLAB, Simulink, Labview, embedded systems.

Programming languages: Python, C, Labview, IEC 61131-3.

Scientific software: MATLAB, Simulink, Minitab, Modelica.

Electronics: Basic use of oscilloscope, function generators, spectrum analyzer, etc.

Languages

Italian Mother tongue
English Fluent
French Fluent
Dutch Basic

1 year teaching and working experience

B1 certificate obtained in 2012

Publications

Manas Mejari, Bojan Mavkov, **M. Forgione**, and Dario Piga. Direct identification of continuous-time LPV state-space models via an integral architecture. *Automatica*, 142:110407, 2022.

Dario Piga, Manas Mejari, and **M. Forgione**. Learning dynamical systems from quantized observations: a Bayesian perspective. *IEEE Transactions on Automatic Control (To appear)*, 2021.

M. Forgione and Dario Piga. *dynoNet*: A neural network architecture for learning dynamical systems. *International Journal of Adaptive Control and Signal Processing*, 35(4):612–626, 2021.

M. Forgione and Dario Piga. Continuous-time system identification with neural networks: model structures and fitting criteria. *European Journal of Control*, 59:69–81, 2021.

Loris Roveda, **M. Forgione**, and Dario Piga. Robot control parameters auto-tuning in trajectory tracking applications. *Control Engineering Practice*, 101:104488, 2020.

B Mavkov, **M. Forgione**, and D Piga. Integrated neural networks for nonlinear continuous-time system identification. *IEEE Control Systems Letters*, 4(4):851–856, 2020.

D. Piga, **M. Forgione**, S. Formentin, and A. Bemporad. Performance-oriented model learning for data-driven MPC design. *IEEE Control Systems Letters*, 3(3):577–582, 2019.

M. Forgione., X. Bombois, and P.M.J. Van den Hof. Data-driven model improvement for model-based control. *Automatica*, 52:118–124, February 2015.

M. Forgione, G. Birpoutsoukis, X. Bombois, A. Mesbah, and P.M.J. Van den Hof. Batch-to-batch model improvement for cooling crystallization. *Control Engineering Practice*, 41:72–82, 2015.

A. Mesbah, X Bombois, J.H.A. Ludlage, H. Hjalmarsson, **M. Forgione**, and P.M.J. Van den Hof. Performance diagnosis and plant re-identification. *International Journal of Control*, 88(11):2264–2276, 2015.

S. Kadam, J. Vissers, **M. Forgione**, R. Geertman, P.J. Daudey, A. Stankiewicz, and H.J.M. Kramer. Rapid crystallization process development strategy from lab to industrial scale with PAT tools in skid configuration. *Org. Process Res & Dev.*, 16:769–780, 2012.

- L. Magni, **M. Forgione**, C. Toffanin, C. Dalla Man, G. De Nicolao, B. Kovatchev, and C. Cobelli. Run-to-run tuning of model predictive control for type 1 diabetes subjects: *in silico* trial. *Journal of Diabetes Science and Technology*, 3:1091–1098, September 2009.
- L.H Peters, G.I Beintema, **M. Forgione**, and M. Schoukens. NARX Identification using Derivative-Based Regularized Neural Networks. In *Decision and Control (CDC), 2012 IEEE 61st Annual Conference on*. IEEE, 2022.
- Bombois X. and **M. Forgione**. Control Design via Bayesian Optimization with Safety Constraints. In *6th IEEE Conference on Control Technology and Applications (CCTA)*. IEEE, 2022.
- Manas Mejari, Bojan Mavkov, **M. Forgione**, and Dario Piga. An integral architecture for identification of continuous-time state-space lpv models. *IFAC-PapersOnLine*, 54(8):7–12, 2021.
- D. Piga, **M. Forgione**, and M. Mejari. Deep learning with transfer functions: new applications in system identification. In *Proc. of the 19th IFAC Symposium System Identification: learning models for decision and control*, Padova, Italy, 2021.
- M. Forgione** and Dario Piga. Model structures and fitting criteria for system identification with neural networks. In *2020 IEEE 14th International Conference on Application of Information and Communication Technologies (AICT)*, pages 1–6. IEEE, 2020.
- M. Forgione**, Dario Piga, and Alberto Bemporad. Efficient calibration of embedded MPC. *IFAC-PapersOnLine*, 53(2):5189–5194, 2020.
- Loris Roveda, **M. Forgione**, and Dario Piga. Two-stage robot controller auto-tuning methodology for trajectory tracking applications. *IFAC-PapersOnLine*, 53(2):8724–8731, 2020.
- Loris Roveda, **M. Forgione**, and Dario Piga. Control Parameters Tuning Based on Bayesian Optimization for Robot Trajectory Tracking.
- M.G. Potters, **M. Forgione**, X. Bombois, and P.M.J. Van den Hof. Least-costly experiment design for uni-parametric linear models: An analytic approach. In *European Control Conference (ECC)*, pages 848–853. IEEE, 2015.
- M. Forgione**, X. Bombois, P.M.J. Van den Hof, and H. Hjalmarsson. Experiment design for parameter estimation in nonlinear systems based on multilevel excitation. In *Proceedings of the 2014 European Control Conference*, pages 25–30, Strasbourg Convention and exhibition center, Strasbourg, France, June 2014.
- M.G. Potters, X. Bombois, **M. Forgione**, P.E. Modén, M. Lundh, H. Hjalmarsson, and P.M.J. Van den Hof. Experiment design in closed loop with unknown, nonlinear or implicit controllers using stealth identification. In *Proceedings of the 2014 European Control Conference*, pages 726–731, June 2014.
- A.C.P.M. Backx, X.J.A. Bombois, P.J. Daudey, **M. Forgione**, R.M. Geertman, P.M.J. Van den Hof, S.S. Kadam, H.J.A. Kramer, J.A.W. Vissers, P. Vonk, and G.M. Westhoff. Towards a more rigorous control of seeded batch crystallization. *Abstract presented*

at the *19th International Symposium on Industrial Crystallization*, Toulouse, France, September 2014.

M. Forgione, X. Bombois, and P.M.J. Van den Hof. Experiment design for batch-to-batch model-based learning control. In *Proceedings of the 2013 American Control Conference (ACC)*, pages 3918–3923, Renaissance Hotel, Washington, D.C., USA, June 2013.

A. Mesbah, X. Bombois, **Forgione, M.**, J. Ludlage, P. Modén, H. Hjalmarsson, and P.M.J Van den Hof. A unified experiment design framework for detection and identification in closed-loop performance diagnosis. In *Decision and Control (CDC), 2012 IEEE 51st Annual Conference on*, pages 2152–2157. IEEE, 2012.

M. Forgione, A. Mesbah, X. Bombois, and P.M.J. Van den Hof. Batch-to-batch strategies for cooling crystallization. In *Proceedings of the 51st IEEE Conference on Decision and Control*, pages 6364–6369, Grand Wailea, Maui, Hawaii, December 2102.

M. Forgione, A. Mesbah, X. Bombois, and P.M.J. Van den Hof. Iterative learning control of supersaturation in batch cooling crystallization. In *Proceedings of the 2012 American Control Conference*, pages 6455–6460, Fairmont Queen Elizabeth, Montreal, Canada, June 2012.

S. Kadam, J. Vissers, **M. Forgione**, P.J. Geertman, R. Daudey, and H.J.M. Kramer. Rapid determination of a near-optimal seeding procedure at an industrial scale batch crystallizer. In *Proceedings of the 18th International Symposium on Industrial Crystallization*, pages 141–142, ETH Zurich, Zurich, Switzerland, September 2011.

J. Vissers, **M. Forgione**, S. Kadam, P.J. Daudey, T. Backx, A.E.M. Huesman, H.J.M. Kramer, and P.M.J. Van Den Hof. Novel control of supersaturation on an industrial scale pharmaceutical batch crystallizer. In *Proceedings of the 18th International Symposium on Industrial Crystallization*, pages 141–142, ETH Zurich, Zurich, Switzerland, September 2011.

The updated list of my publications is also available on my personal website.

Direct link: <http://www.marcoforgione.it/publications.html>