

Curriculum Vitae

Marco Maria Nicotra

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Research Interests

Broad Areas of Interest: Nonlinear Systems, Constrained Control, Optimization.

Target Applications: Unmanned Aerial Vehicles, Human-Robot Interaction, Spacecraft, Quantum Systems, Battery Management Systems, Wind Farms.

Career

August 2018 – Present: *Assistant Professor* at the Department of Electrical, Computer and Energy Engineering of the University of Colorado Boulder

October 2016 – July 2018: *Research Fellow* at the Department of Aerospace Engineering of the University of Michigan.

Education

September 2016: *Joint Ph.D. Degree* from the following institutions

- Université Libre de Bruxelles: Ph.D. in Engineering Sciences.
- University of Bologna: Ph.D. in Automation and Operational Research.

September 2012: *Double M.S. Degree* obtained from the T.I.M.E. Association members

- Politecnico di Milano: M.S. in Mechanical Engineering (*Summa cum Laude*).
- Université Libre de Bruxelles: M.S. in Electromechanical Engineering (*Summa cum Laude*).

June 2009: *B.S. Degree* in Mechanical Engineering from Politecnico di Milano. (*Summa cum Laude*)

Honors and Awards

Conference Awards

- **2019: Finalist for Best Student Paper** (Student: D. Liao-McPherson). European Control Conference. Paper: “*A Semismooth Predictor Corrector Method for Suboptimal Model Predictive Control*”
- **2014: Honourable Mention for the IFAC Young Author Prize**. IFAC World Congress. Paper: “*Taut cable control of a tethered UAV*”

Scholarships

- **FNRS Mobility Grant no. 2015/V 3/5/117**
Supported a three-month visiting scholarship at Carnegie Mellon University.
- **FRIA Scholarship Grant no. 5208615F**
Fully funded my graduate studies.

Funding and Grants

National Research Foundation

- **CMMI 1904441**: “*Collaborative Research: Real-time iteration governor for constrained nonlinear model predictive control*”, 2019.
Amount: \$431,876, PI: M.M. Nicotra, Co-PIs: None.
- **NSF QII-TAQS 1936303**: “*Quantum control of ultracold atoms in optical lattices for space inertial sensing*”, 2019.
Amount: \$1,928,242 (my share: \$320,391), PI: D. Anderson, Co-PIs: M. Holland, M.M. Nicotra, P. Axelrad, and A. Zozulya.

CU Boulder Internal Funding

- **EEF Major Proposal**: “*Modernization of the Control Systems Laboratory*”, 2019. Amount: \$101,581.08, PI: M.M. Nicotra, Co-PIs: None.
- **QuEST Seed Grant**: “*Advanced Control Algorithms for Trapped-ion Quantum Metrology*”, 2019. Amount: \$57,850.00, PI: M.M. Nicotra, Co-PIs: None.
- **ASIRT Seed Grant**: “*Mobile Sensing Using UAVs to Enable Accurate Wind Field Estimation Across Wind Farms: Extensions to Large Wind Farms, Multiple UAVs, and Time-Varying Wind Fields*”, 2019. Amount: \$8,000.00, PI: L. Pao, Co-PIs: M.M. Nicotra, C. Dixon.

Teaching Activities

Graduate Courses

- ECEN 5738 Theory of Nonlinear Systems, F18
- ECEN 5038 Control Systems Laboratory, S20, S21

Undergraduate Courses

- ECEN 2310 Programming with Mathematical Software, F19, F20
- ECEN 4638 Control Systems Laboratory, S19, S20, S21

Advising and Mentoring

Doctoral Students

1. Marco Pomponio, ECEE Ph.D. student, January 2021 - present.
2. Terrence Skibik, ECEE Ph.D. student, August 2019 - present.
3. Jieqiu Shao, ECEE Ph.D. student, August 2019 - present.
4. David James Pasley, ECEE Ph.D. student (co-advised), August 2018 - present.
5. Thomas Dearing, ECEE Ph.D. student, (co-advised), August 2018 - present.

Master Students

1. Jonathan Hanson, ECEE M.S. student, January 2021 - present.
2. Anne Cross Theurkauf, AES M.S. student, August 2019 - May 2020.
3. Jieqiu Shao, ME M.S. student, May 2019 - August 2019.

Exchange Students

1. Andrea Mengozzi, University of Bologna, M.S. student, Sept 2019 - February 2020.
2. Kelly Merckaert, Vrije Universiteit Brussel, Ph.D. student, February 2019 - July 2019.
3. Bryan Convens, Vrije Universiteit Brussel, Ph.D. student, February 2019 - July 2019.

Service Activities

Professional Service

Associate Editor

- IEEE Conference on Control Technology and Applications (2020)
- American Control Conference (2020)

Peer Reviewer

- *Journals:* IEEE Transactions on Automatic Control, IEEE Transactions on Control System Technologies, Journal of Guidance, Control, and Dynamics, Control System Society Letters, Automatica
- *Conferences:* American Control Conference, Conference on Decision and Control, IFAC World Congress, International Conference on Robotics and Automation.

Technical Committees

- Member of the Technical Committee for Aerospace Controls, Dec. 2018 - present

Departmental Service

- Chair of the Undergraduate Teaching Laboratory Committee, Sept. 2020 - present
- Member of the Social Activities Sub-committee, November 2020 – present.
- Member of the Faculty Search Committee, Sept 2019 - May 2020.
- Member of the Undergraduate Curriculum Committee, Sept 2018 - May 2020.
- Member of the Procurement Specialist Hiring Committee, May 2019 - July 2019.
- Member of the Climate Committee, Sept 2018 - May 2019.

List of Publications

Journal Articles

- [J1] T.L. Dearing, X. Chen, M.M. Nicotra, “*Stabilizing Formation Systems With Nonholonomic Agents*”, IEEE Control Systems Letters, vol. 5(2), pp. 403-408, 2020.
- [J2] D. Liao-McPherson, M.M. Nicotra, A.L. Dontchev, I.V. Kolmanovsky, V. Veliov, “*Sensitivity-based Warmstarting for Nonlinear Model Predictive Control with Polyhedral State and Control Constraints*”, IEEE Transactions on Automatic Control, vol 65(10), pp. 4288-4294, 2020.
- [J3] M.M. Nicotra, D. Liao-McPherson, L. Burlion, I.V. Kolmanovsky, “*Spacecraft Attitude Control with Nonconvex Constraints: An Explicit Reference Governor Approach*”, IEEE Transactions on Automatic Control, vol 65(8), pp. 3677-3684, 2020.
- [J4] D. Liao-McPherson, M.M. Nicotra, I.V. Kolmanovsky, “*Time-distributed optimization for real-time model predictive control: Stability, robustness, and constraint satisfaction*”, Automatica, vol. 117, p. 108973, 2020.
- [J5] T. Nguyen, M.M. Nicotra, E. Garone, “*A Geodesic Approach for the control of tethered quadrotors*”, AIAA Journal of Guidance, Control, and Dynamics, vol 43(4), pp. 854-862, 2020.
- [J6] A.L. Dontchev, M. Huang, I.V. Kolmanovsky, M.M. Nicotra, “*Inexact Newton-Kantorovich Methods for constrained Nonlinear Model Predictive Control*”, IEEE Transactions on Automatic Control, vol 64(9), pp. 3602-3615, 2019.
- [J7] M.M. Nicotra, T. Nguyen, E. Garone, I.V. Kolmanovsky, “*Explicit Reference Governor for the Constrained Control of Time-Delayed Linear Systems*”, IEEE Transactions on Automatic Control, vol. 64(7), pp. 2883-2889, 2019.
- [J8] M.M. Nicotra, D. Liao-McPherson, I.V. Kolmanovsky, “*Embedding constrained Model Predictive Control in a continuous-time dynamic feedback*”, IEEE Transactions on Automatic Control, vol 64(5), pp. 1932-1946, 2019.
- [J9] A.L. Dontchev, I.V. Kolmanovsky, M.I. Krastanov, M.M. Nicotra, V.M. Veliov, “*Lipschitz Stability in Discretized Optimal Control*”, SIAM Journal on Control and Optimization, vol. 57(1), pp. 468-489, 2019.
- [J10] M.M. Nicotra, E. Garone, “*The Explicit Reference Governor: A General Framework for the Closed-Form Control of Constrained Nonlinear Systems*”, Control Systems Magazine, vol. 38(4), pp. 89-107, 2018.
- [J11] E. Garone, M.M. Nicotra, L. Ntogramatzidis, “*Explicit Reference Governor for linear systems*”, International Journal of Control, vol. 91(6), pp. 1415-1430, 2018.
- [J12] M.M. Nicotra, R. Naldi, E. Garone, “*Nonlinear control of a tethered UAV: the taut cable case*”, Automatica, vol. 78, pp 174-184, 2017.
- [J13] M.M. Nicotra, E. Garone, I. V. Kolmanovsky, “*A Fast Reference Governor for linear systems subject to convex constraints*”, AIAA Journal of Guidance, Control, and Dynamics, vol 40, pp. 461-465, 2016.

- [J14] E. Garone, M.M. Nicotra, “*Explicit Reference Governor for constrained nonlinear systems*”, IEEE Transactions on Automatic Control, vol. 61, no. 5, pp. 1379-1384, 2016.
- [J15] M.M. Nicotra, R. Naldi, E. Garone, “*Sufficient conditions for the stability of a class of second order systems*”, Systems and Control Letters, vol. 84, pp 1-6, 2015.

Under Review

- [J16] A. Goldar, R. Romagnoli, LD Couto, M Nicotra, M Kinnaert, E Garone, “*Low-Complexity Fast Charging Strategies Based on Explicit Reference Governors for Li-Ion Battery Cells*”, to appear in: IEEE Transactions on Control Systems Technology.
- [J17] D. Liao-McPherson, T. Skibik, J. Leung, I.V. Kolmanovsky, M.M. Nicotra, “*An Analysis of Closed-Loop Stability for Linear Model Predictive Control Based on Time-Distributed Optimization*”, submitted to: IEEE Transactions on Automatic Control.
- [J18] D. Liao-McPherson, T. Skibik, T. Cunis, I.V. Kolmanovsky, M.M. Nicotra, “*A Feasibility Governor for Enlarging the Region of Attraction of Linear Model Predictive Controllers*”, submitted to: IEEE Transactions on Automatic Control.
- [J19] B. Convens, K. Merckaert, B. Vanderborght, M.M. Nicotra, “*A Distributed Explicit Reference Governor for the Safe On-Board Control of a Nano-Quadrotor Swarm*”, submitted to: IEEE Transactions on Robotics.

Conference Proceedings

- [C1] T.L. Dearing, C.D. Petersen, M.M. Nicotra, X. Chen, “*Fuel-Balanced Formation Flight Control of Underactuated Satellites*”, Proc. of the American Control Conference, pp. 4319-4324, 2020.
- [C2] D.J. Pasley, M.M. Nicotra, L. Pao, J. King, C. Bay, “*Mobile Sensing for Wind Field Estimation in Wind Farms*”, Proc. of the American Control Conference, pp. 4071-4076, 2020.
- [C3] G. Ding, J.J. Koh, K. Merckaert, B. Vanderborght, M.M. Nicotra, C. Heckman, A. Roncone, L. Chen, “*Distributed Reinforcement Learning for Cooperative Multi-Robot Object Manipulation*”, Proc. of 19th International Conference on Autonomous Agents and MultiAgent Systems, pp. 1831-1833, 2020.
- [C4] D. Liao-McPherson, M.M. Nicotra, I.V. Kolmanovsky, “*A Semismooth Predictor Corrector Method for Suboptimal Model Predictive Control*”, Proc. of the IEEE European Control Conference, pp. 2749-2755, 2019.
- [C5] A. Cotorruelo Jiménez, D. Limón, M.M. Nicotra, E. Garone, “*Explicit Reference Governor Toolbox (ERGT)*”, Proc. of IEEE 4th International Forum on Research and Technology for Society and Industry, pp. 1-6, 2018.
- [C6] L. Burlion, M.M. Nicotra, I.V. Kolmanovsky, “*A Fast Reference Governor for the Constrained Control of Linear Discrete-time Systems with Parametric Uncertainties*”, Proc. of the IEEE Conference on Decision and Control, pp. 6289-6294, 2018.

- [C7] D. Liao-McPherson, M.M. Nicotra, I.V. Kolmanovsky, “*A Semismooth Predictor Corrector Method for Real-Time Parametric Optimization with Applications in Model Predictive Control*”, Proc. of the IEEE Conference on Decision and Control, pp. 3600-3607, 2018.
- [C8] K. Merkaert, M.M. Nicotra, B. Vanderborght, E. Garone, “*Constrained Control of Robotic Manipulators using the Explicit Reference Governor*”, to appear in: IEEE/RSJ International Conference on Intelligent Robots and Systems, 2018.
- [C9] M.M. Nicotra, D. Liao-McPherson, I.V. Kolmanovsky, “*Dynamically Embedded Model Predictive Control*”, Proc. of the American Control Conference, pp. 4957-4962, 2018.
- [C10] R. Romagnoli, L.D. Couto, M.M. Nicotra, M. Kinnaert, E. Garone, “*Computationally-Efficient Constrained Control of the State-of-Charge of a Li-ion Battery Cell*”, Proc. of the IEEE Conference on Decision and Control, pp. 1433-1439, 2017.
- [C11] B. Convens, K. Merkaert, M.M. Nicotra, R. Naldi, E. Garone, “*Control of Fully Actuated Unmanned Aerial Vehicles with Actuator Saturation*”, Proc. of the 20th IFAC World Congress, IFAC-PapersOnLine, vol. 50, pp. 12715-12720, 2017.
- [C12] M.M. Nicotra, E. Garone, “*An Explicit Reference Governor for the robust constrained control of nonlinear systems*”, Proc. of the IEEE Conference on Decision and Control, pp. 1502-1507, 2016.
- [C13] M.M. Nicotra, R. Naldi, E. Garone, “*A Robust Explicit Reference Governor for the constrained control of Unmanned Aerial Vehicles*”, Proc. of the American Control Conference, pp. 6284-6289, 2016.
- [C14] L.D. Couto, J. Schorsh, M.M. Nicotra, M. Kinnaert, “*SOC and SOH estimation for Li-ion batteries based on an equivalent hydraulic model. Part I: SOC and surface concentration estimation*”, Proc. of the American Control Conference, pp. 4022-4028, 2016.
- [C15] M.M. Nicotra, E. Garone, “*Control of Euler-Lagrange systems subject to constraints: an Explicit Reference Governor approach*”, Proc. of the IEEE Conference on Decision and Control, pp. 1154-1159, 2015.
- [C16] M.M. Nicotra, E. Garone, “*Explicit Reference Governor for continuous time nonlinear systems subject to convex constraints*”, Proc. of the American Control Conference, pp. 4561-4566, 2015.
- [C17] M.M. Nicotra, M. Bartulovic, E. Garone, B. Sinopoli, “*A Distributed Explicit Reference Governor for constrained control of multiple UAVs*”, Proc. of the 5th IFAC Workshop on Distributed Estimation and Control in Networked Systems, IFAC Proceedings Volumes, vol. 48 (22), pp. 156-161, 2015.
- [C18] M.M. Nicotra, R. Naldi, E. Garone, “*Taut cable control of a tethered UAV*”, Proc. of the 19th IFAC World Congress, IFAC Proceedings Volumes, vol. 47(3), pp. 3190-3195, 2014.
- [C19] S. Eeckout, M.M. Nicotra, R. Naldi, E. Garone, “*Nonlinear control of an actuated tethered airfoil*”, Proc. of the 22nd Mediterranean Conference on Control and Automation, pp. 1412-1417, 2014.
- [C20] M.M. Nicotra, E. Garone, R. Naldi, “*Nested saturation control of an UAV carrying a suspended load*”, Proc. of American Control Conference, pp. 3585-3590, 2014.

- [C21] M.M. Nicotra, A. Buttafuoco, M. Kinnaert, “*Hybrid model for haptic lung palpation*”, Proc. of the 16th IFAC Symposium on System Identification, IFAC Proceedings Volumes, vol. 16 (1), pp. 1431-1436, 2012.

Under Review

- [J20] T. Skibik, D. Liao-McPherson, T. Cunis, I.V. Kolmanovsky, Marco M Nicotra, “*Feasibility Governor for Linear Model Predictive Control*”, submitted to: the American Control Conference.
- [J21] A.C. Theurkauf, M.M. Nicotra, “A Batch Reroll Strategy for Chopped RAndom-Basis Quantum Control and its Application to Cold Atom Lattice Interferometry”, submitted to: the American Control Conference.