Marco Tulio Angulo

11 Queensberry St. Apartment 15, Boston, Massachusetts, USA, 02215
m.anguloballesteros@neu.edu • +1 (617) 784-4691 • http://bit.ly/1RowaxT

RESEARCH INTERESTS

One sentence summary: I aim to understand, diagnose and control complex systems by blending system theory (e.g., control theory and system identification) with network science.

Fundamental limitations of network reconstruction • Interplay between network structure and functionality in complex systems • Optimization of uncertain systems • Performance tradeoffs in the differentiation of noisy signals • Observability and observer design for uncertain systems • Robust control with emphasis on discontinuous algorithms.

PUBLICATION SUMMARY

9 Journal / 12 Conference papers with 108 citations (h-index 7).

EDUCATION

Harvard Medical School, Channing Division of Network Medicine, Brigham and Women's Hospital, Boston, MA.

Sponsored Staff Collaborator 2015 – 2016
- Project title: *Interplay between network structure and dynamics in complex networks*.
- Supervision by Prof. Yang-Yu Liu.

Center for Complex Network Research, Northeastern University, Boston, MA.

Postdoctoral Research Associate 2015 – 2016
Visiting Research Scholar 2014 – 2015
- Project title: *Sensitivity of Complex Networks*.
- Supervision by Prof. Albert-László Barabási.

UNAM, Universidad Nacional Autónoma de México, México City, México.

Dr. Eng. in Automatic Control 2009 – 2012
- Thesis title: *Robustness and fragility in the control and observation of systems with noise and perturbations.*
- Supervision by Prof. Leonid Fridman and Prof. Jaime Moreno.

M. Eng. in Electrical Engineering and Automatic Control 2007 – 2009
- Thesis title: *Output-feedback exact finite-time stabilization of disturbed LTI systems.*
- Supervision by Prof. Leonid Fridman.

UAQ, Universidad Autónoma de Querétaro, Querétaro, México.

Bachelors' Degree in Automation and Mechatronic Systems 2002 – 2007
- Thesis title: *Disturbance Rejection using Iterated Integrals.*
- Supervision by Prof. Victor Manuel Hernández

PROFESSIONAL EXPERIENCE

UAQ, Universidad Autónoma de Querétaro, Querétaro, México.

Full-time Professor, Faculty of Engineering 2012 – 2013

Course lecturer for *Selected Topics in Nonlinear Control Theory* (graduate level) and *Laboratory of Numerical Methods* (undergraduate level).

ACADEMIC DISTINCTIONS

2014	Level 1 Member of the Mexican **National System of Researchers** (SNI)
2014	Postdoc **Scholarship** from the Mexican National Council of Science and Technology
2012	Dr. Eng degree with **summa cum laude**
2010	**Alfonso Caso Medal** to the academic merit, given to the most distinguished graduate of the program
2009	M. Eng degree with **summa cum laude**
2007	**Diploma to the Academic Excellence**, given to the most distinguished graduate of the Bachelor program
2007	**Best** Bachelor Thesis
2007	Bachelor degree with **summa cum laude**
2005	**First Prize in the Mechatronic Contest**, first International Engineering Congress

SCIENTIFIC VISITS/ INVITED TALKS

MIT, Networks Control Group, Boston, US. 2015
Prof. Domitilla DelVecchio

Harvard Medical School, Channing Division of Network Science, Boston, US. 2014
Prof. Yang-Yu Liu

Boston University, Center for Information & Systems Engineering, Boston, US. 2013
Prof. Christos Cassandras
IRCCyN, Institut de Recherche en Communications et Cybernétique de Nantes, France.
Prof. Claude Moog 2009 and 2011

PROFESSIONAL SERVICES

Reviewer for International Congresses (CDC, ACC, VSS, etc) and Journals (Automatica, IJC, IJSS, etc).
Co-organizer of the 2016 Network Control symposium (Korea, 2016).

SKILLS

Operating systems: MacOS and Linux.
Programming: MATLAB, Simulink, LaTeX, C and Mathematica.
Hardware description languages: VHDL.
Languages: Spanish (native), English (proficient).

PERSONAL INFORMATION

Date of birth: January 16, 1985.
Nationality: Mexican.
Civil status: Married.
Other interests: Zen meditation, calligraphy, watercolor painting, history of the mathematical sciences.

REFERENCES

Professor Albert-László Barabási
Robert Gray Dodge Professor of Network Science and Director of the Center for Complex Network Research, Northeastern University.
Department of Medicine and Network Medicine, Harvard Medical School.
Center for Cancer Systems Biology, Dana Farber Cancer Institute.
11th Floor, 177 Huntington Avenue, Boston, MA 02115
alb@neu.edu • +1 (617) 373-2355

Professor Yang-Yu Liu
Assistant Professor, Harvard Medical School.
Associate Scientist, Channing Division of Network Medicine, Brigham and Women's Hospital.
181 Longwood Avenue, Boston, MA 02115
yyl@channing.harvard.edu • +1 (617) 525-2714

Professor Jaime A. Moreno
Head of the Division of Electric and Computer Engineering.
Institute of Engineering, Universidad Nacional Autónoma de México (UNAM).
Building 12, Circuito Exterior, Ciudad Universitaria, México City, México 04510
JMorenoP@iingen.unam.mx • +1 (52-55) 5623-3683

Professor Leonid Fridman
Department of Control Engineering and Robotics, Division of Electrical Engineering.
Faculty of Engineering, UNAM.
Building T, Circuito Exterior, Ciudad Universitaria, México City, México 04510
lfridman@unam.mx • +1 (52-55) 5622-3016

PUBLICATION LIST

Journal: 1 NatPhys, 2 IJSS, 4 Automatica, 1 JFI, 1 IET.
International conferences: 5 CDC, 1 IFAC, 2 VSS, 1 CCE, 1 ACC, 1 ADHS, 1 SysTol

Journal papers

[1] Marco Tulio Angulo. "Nonlinear extremum seeking inspired on second order sliding modes". *Automatica*, vol. 57, pp. 51-55, 2015.

[2] Marco Tulio Angulo, Yang-Yu Liu, and Jean-Jacques Slotine. "Network motifs emerge from interconnections that favour stability". *Nature Physics*, vol. 11, pp. 848-852, 2015.

[3] Marco Tulio Angulo and Valentin Carrillo-Serrano. "Estimating rotor parameters in induction motors using high-order sliding mode algorithms". *IET Control Theory & Applications*, vol. 9, iss. 4, pp. 573-578, 2014.

[4] Marco Tulio Angulo, Jaime A. Moreno and Leonid Fridman. "On functional observers for linear systems with unknown inputs and HOSM differentiators". *Journal of the Franklin Institute*, vol. 351 (4), pp. 1982-1994, 2014.

[5] Marco Tulio Angulo, Leonid Fridman and Jaime A. Moreno. "Output-feedback finite-time stabilization of disturbed feedback linearizable nonlinear systems". *Automatica*, vol. 49 (9), pp. 2767-2773, 2013.

[6] Marco Tulio Angulo, Jaime A. Moreno and and Leonid Fridman. "Robust exact uniformly convergent arbitrary order differentiator". *Automatica*, vol. 49 (8), pp.2489-2495, 2013.

[7] Marco Tulio Angulo, Leonid Fridman and Arie Levant. "Output-feedback finite-time stabilization of disturbed LTI systems". *Automatica*, vol 48(4), pp. 606-611, 2012.

[8] Marco Tulio Angulo, Leonid Fridman and Arie Levant. "Robust exact finite-time output based control using high-order sliding modes". *International Journal of Systems Science*, vol 42(11), pp 1847-1857, 2011.

[9] Vadim Azhmyakov and Marco Tulio Angulo. " Applications of the strong approximability property to a class of affine switched systems and to relaxed differential equations with affine structure". *International Journal of Systems Science*, vol 42(11), pp. 1899-1907, 2011.

Conference papers

[1] M.T. Angulo and C. Verde. "Second Order Sliding Mode Algorithms for the Reconstruction of Leaks". *2nd International Conference on Control and Fault-Tolerant Systems*, pp. 566 - 571, Nice, France, 2013.

[2] C. Kunusch, J.A. Moreno, and M.T. Angulo. "Identification and observation in the anode line of PEM fuel cell stacks". *52nd IEEE Annual Conference on Decision and Control (CDC)*, pp. 1665 - 1670, Florence, Italy, 2013.

[3] M.T. Angulo, J.A. Moreno, and L. Fridman. "Optimal gain for the Super-Twisting differentiator in the presence of measurement noise". *American Control Conference (ACC)*, pp. 6154-6159, Montreal, Canada, 2012.

[4] M.T. Angulo, J.A. Moreno, and L. Fridman. "Some remarks about the tradeoffs between exactness and robustness in control". *12th International Workshop on Variable Structure Systems (VSS)*, pp. 82-87, Mombay, India, 2012.

[5] M.T. Angulo, J.A. Moreno, and L. Fridman. "The differentiation error of noisy signals using the Generalized Super-Twisting differentiator". *51st IEEE Annual Conference on Decision and Control (CDC)*, pp. 7383-7388, Hawaii, USA, 2012.

[6] L. Fraguela, M.T. Angulo, J.A. Moreno, and L. Fridman. "Design of a prescribed convergence time uniform Robust Exact Observer in the presence of measurement noise". *51st IEEE Annual Conference on Decision and Control (CDC)*, pp. 6615-6620, Hawaii, USA, 2012.

[7] Marco Tulio Angulo, Jaime A Moreno, and Leonid Fridman. “On Functional Observers for Linear Systems with Unknown Inputs and HOSM Differentiators”. *IFAC World Congress*, vol. 81(1), pp. 1922-1927, Milan, Italy, 2011.

[8] M.T. Angulo, J.A. Moreno, and L. Fridman. “An exact and uniformly convergent arbitrary order differentiator”. *50th IEEE Conference on Decision and Control and European Control Conference (CDC-ECC)*, pp. 7629-7634, Orlando, USA, 2011.

[9] M.T. Angulo, L. Fridman, C.H. Moog, and J. Moreno. “Output feedback design for exact state stability of flat nonlinear systems”. *11th International Workshop on Variable Structure Systems (VSS)*, pp. 32-38, México City, México, 2010.

[10] M.T. Angulo, J. Moreno, and R. Lazáro. “Robust dissipative observer design for nonlinear systems”. *7th International Conference on Electrical Engineering Computing Science and Automatic Control (CCE)*, pp. 111-115, Mexico, 2010.

[11] Marco Tulio Angulo and Arie Levant. “On robust output based finite-time control of LTI systems using HOSMs”. *IFAC Conference on Analysis and Design of Hybrid Systems*, vol. 3(1), pp. 222-227, Zaragaza, Spain, 2009.

[12] M.T. Angulo and L. Fridman. “Output-based Finite Time Control of LTI systems with matched perturbations using HOSM”. *48th IEEE Conference on Decision and Control held jointly with the 28th Chinese Control Conference (CDC/CCC)*, pp. 6095-6100, Shangai, China, 2009.

In revision, preprints and preparation

[1] Marco Tulio Angulo, Jaime A. Moreno, Gabor Lippner, Albert-László Barabási and Yang-Yu Liu. “Fundamental limitations of network reconstruction”. *Submitted to PNAS*, (arXiv preprint 1508.03559), October 2015

[2] Marco Tulio Angulo and Jean-Jacques Slotine. “Qualitative stability of nonlinear networked systems”. *Submitted to the IEEE Transactions on Automatic Control*, November 2015.

[3] Marco Tulio Angulo, Yang-Yu Liu and Albert-László Barabási.“Sensitivity of complex networks”. In preparation for its submission to Physical Review Letters, December 2015 .

[4] Marco Tulio Angulo, “Dissipative design of Nonlinear Adaptive Observers”. In preparation for its submission to the International Journal of Control, 2016.

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