RAFAL GOEBEL

COORDINATES

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EDUCATION

Universities attended:

94-00 University of Washington, Seattle, WA, USA

92-93 Rutgers University, New Brunswick, NJ, USA

89-92, 93-94 Maria Curie Sklodowska University, Lublin, Poland

Degrees:

Ph.D. 2000, Department of Mathematics, University of Washington, Seattle; advisor: R.T. Rockafellar, thesis: *Convexity, Convergence and Feedback in Optimal Control*

M.Sc. 1994, Institute of Mathematics, University of Maria Curie-Sklodowska, Lublin, Poland (graduated with highest honors); thesis: *On the Stability of an L^2-angle*

EMPLOYMENT

19- Professor, Department of Mathematics and Statistics, Loyola University Chicago

13-19 Associate Professor, Department of Mathematics and Statistics, Loyola University Chicago

08-13 Assistant Professor, Department of Mathematics and Statistics, Loyola University Chicago

05-07 Part-Time Lecturer, Department of Mathematics, University of Washington

fall 05 Part-Time Researcher, Department of Electrical and Computer Engineering, University of California, Santa Barbara

02-04 Post-Doctoral Fellow, Department of Electrical and Computer Engineering, University of California, Santa Barbara

00-02 Post-Doctoral Fellow and Instructor, Departments of Mathematics of University of British Columbia and Simon Fraser University, Vancouver, Canada

summer 98 Researcher, International Institute for Applied Systems Analysis, Vienna, Austria (Young Scientist Summer Program)

94-00 Teaching and Research Assistant, Department of Mathematics, University of Washington

GRANT AND OTHER SUPPORT

fall 23 Invited Researcher, LAAS-CNRS and INSA, Toulouse, France

summer 17 Loyola University Summer Research Stipend

14-20 Simons Foundation Collaboration Grant 315326

summer 14 Loyola University Summer Research Stipend

10-13 National Science Foundation Research Grant 1008602, with E.N. Barron and R.R. Jensen

summer 12 Loyola University Summer Research Stipend

AWARDS AND HONORS

20 Test of Time Award, The 23rd International Conference on Hybrid Systems: Computation and Control, with R. Sanfelice and A. Teel

19 Best Paper Award at the 11th IFAC Symposium on Nonlinear Control Systems

10 IEEE Control Systems Society, 2010 Control Systems Magazine Outstanding Paper Award, with R. Sanfelice and A. Teel

09 SIAM Activity Group on Control and Systems Theory Prize

winter 00 McFarlan Fellowship, Department of Mathematics, University of Washington

93-94 Scholarship of the Polish Ministry of Education

92-93 Ambassadorial Scholarship from Rotary International

TEACHING EXPERIENCE AND TRAINING

08-present Loyola University Chicago, Assistant, Associate, and Full Professor

experience includes: Applied Calculus I and II, Calculus I and II, Elementary Number Theory, Multivariable Calculus, Ordinary Differential Equations, Linear Algebra and Differential Equations, Introduction to Real Analysis I and II, Introduction to Complex Analysis, Topics: Functional Analysis, Introduction to Optimization, Nonlinear Systems and Elements of Control, Applied Dynamical Systems

05-07 University of Washington, Part-time Lecturer

experience includes: Calculus II, Calculus III, Discrete Mathematical Modeling, Nonlinear Optimization

00-02 Simon Fraser University and University of British Columbia, Instructor

experience includes: Introductory Mathematics for Social & Management Sciences, Integral Calculus, Ordinary Differential Equations

94-99 University of Washington, Teaching Assistant and Instructor

experience includes: Teaching Assistant Training; Teaching Assistant for: calculus, upper level undergraduate and graduate optimization courses; Instructor for: Calculus I, Linear Optimization; Tutor at Math Study Center

93-94 University of Maria Curie-Sklodowska

Teacher Education Program, teaching elementary and high school mathematics classes

OTHER TEACHING

May 2015 Instructor for (graduate level) course Hybrid Systems : Modeling, Stability, Robustness, and the Math Behind It, 21 contact hours, International Graduate School on Control, European Embedded Control Institute, France

March 2014 Teaching Assistant for (graduate level) course Hybrid Dynamical Systems, 9 contact hours, Elgersburg School, Technische Universiät Ilmenau, Germany

November 2013 Instructor for (graduate level) course Set-Valued and Convex Analysis in Dynamics and Control, 10 contact hours, University of Maria Curie-Sklodowska, Poland

ADMINISTRATIVE POSITIONS

13-19 Graduate Program Director for MS in Mathematics program

24- Graduate Program Director for MS in Mathematics program

RECENT SERVICE TO THE UNIVERSITY

22- Member, Rank and Tenure Committee, College of Arts & Sciences

22-23 Member, FTTT Applied Mathematics Hiring Committee, Department of Mathematics and Statistics

21-22 Member, Academic Technology Committee

21-22 Member, FTTT Applied Mathematics Hiring Committee, Department of Mathematics and Statistics

20-21 Member, FTTT Mathematics Hiring Committee, Department of Mathematics and Statistics

18-19 Chair, FTTT Mathematics Hiring Committee, Department of Mathematics and Statistics

17-18 Chair, FTTT Statistics Hiring Committee, Department of Mathematics and Statistics

17-19 Member, Math 162: Calculus II revision committee, Department of Mathematics and Statistics

16-17 Member, Mid-Probationary Review committee (for two assistant professors in the department)

16-18 Chair, Applied Mathematics Major committee, Department of Mathematics and Statistics

15-16 Math Major Revision Committee, Department of Mathematics and Statistics

15-16 Chair, FTTT Statistics Hiring Committee, Department of Mathematics and Statistics

12-16 Co-organizer, Undergraduate Colloquium in Mathematical Sciences, funded by College of Arts and Sciences

14-15 Chair, FTTT Statistics Hiring Committee, Department of Mathematics and Statistics

12-15 Member, Faculty Development Review Committee

12-14 Member, Engineering Study Group (to develop undergraduate engineering program)

SERVICE TO THE COMMUNITY

Senior Editor	Systems and Control Letters, 2019-present
Assoc. Editor	Journal Mathematics of Control, Signals and Systems, 2016-present
	SIAM Journal on Control and Optimization, 2015-present
	Annales Universitatis Mariae-Curie Skłodowska, Sectio A, 2012-present
	Applied Mathematics and Optimization, 2019-2025
	Systems and Control Letters, 2011-2018
organizer	special session on *Set-valued and Nonsmooth Analysis in Systems and Control: Generalized Lyapunov Methods and Beyond*, 11th IFAC Symposium on Nonlinear Control Systems, Vienna, Austria 2019
	special session on *Variational Analysis in Dynamics and Control*, IEEE Conference on Decision and Control, Las Vegas 2016; co-organizer: R. Sanfelice
	special session on *Recent Advances in Stability and Control of Hybrid Systems*, IFAC Symposium on Nonlinear Control Systems, Monterey 2016; co-organizer: R. Sanfelice
	special session on *Variational Analysis, Optimization, and Control*, AMS Sectional Meeting, Loyola University Chicago, 2015
	Midwest Optimization Meeting, Loyola University Chicago, 2014
	session on *Variational Analysis in Dynamics and Control*, IEEE Conference on Decision and Control, Los Angeles 2014
	minisymposium on *Variational Analysis in Dynamics and Control*, SIAM Conference on Control and Applications, San Diego 2013
	session on *Variational Analysis, Control and Optimization*, Mathematical Congress of the Americas, Guanajuato, Mexico 2013; co-organizers: G. Silva, Brazil and J. Rosenblueth, Mexico.
	minisymposium on *Analysis of hybrid, measure-driven, and linear complementarity dynamical systems*, SIAM Conference on Control and Applications, Denver 2009
	session on *Variational and Convex Analysis Techniques for Problems Involving Dynamics*, International Symposium on Mathematical Programming, Chicago 2009
referee	Automatica, IEEE Transactions on Automatic Control, Journal of Convex Analysis, Journal of Mathematical Analysis and Applications, SIAM Journal on Control and Optimization, SIAM Journal on Optimization, Systems and Control Letters, International Journal of Robust and Nonlinear Control
reviewer	Mathematical Reviews, 2005-present

RECENT CONFERENCE PARTICIPATION WITH PRESENTATION

24 61st Annual Allerton Conference on Communication, Control, and Computing, Urbana-Champaign, September 17-19.

Analysis and Desigh of Hybrid Systems, Boulder, July 1-3. (keynote speaker, full support by organizers)

Midwest Workshop on Control and Game Theory, Evanston, IL, April 27-28.

23 Geometry, Topology and Control System Design Workshop, Banff, Canada, June 11-16. (local support by organizers)

22 59th Annual Allerton Conference on Communication, Control, and Computing, Monticello, IL, September 26-29.

21 23rd Midwest Optimization Meeting, Grand Valley State University, Allendale, MI, October 29-30. (local support by organizers)

19 IFAC Symposium on Nonlinear Control Systems, Vienna, Austria, September 4-6.

Workshop on Nonsmooth and Variational Analysis, Vienna, Austria, January 28 - February 1. (local support by the organizers)

18 Midwest Optimization Meeting, Oxford, OH, October 12-13

IEEE Conference on Decision and Control. Miami Beach, FL, December 17-19

17 Splitting Algorithms, Modern Operator Theory, and Applications Workshop, Oaxaca, Mexico. September 17-22. (local support by organizers)

SIAM Conference on Control and its Applications, Pittsburgh. July 10-14.

Hybrid Dynamical Systems: Optimization, Stability, and Applications, University of Trento, Italy, January 9-11. (local support by organizers)

16 IEEE Conference on Decision and Control, Las Vegas. December 12-14.

10th IFAC Symposium on Nonlinear Control Systems, Monterey. August 23-25.

15 International Conference on Variational Analysis, Optimization and Quantitative Finance, University of Limoges, France. (local support by organizers)

14 IEEE Conference on Decision and Control, Los Angeles

SIAM Conference on Optimization, San Diego

13 Midwest Optimization Meeting, Waterloo, Canada (full support by organizers)

Mathematical Congress of the Americas, Guanajuato, Mexico

SIAM Conference on Control and its Applications, San Diego

RECENT CONFERENCE PARTICIPATION WITHOUT PRESENTATION

24 11th Midwest Workshop on Control and Game Theory, Urbana-Champaign, April 26-27.

23 PDEs, Control, and Observation of Systems, Toulouse, France, October 17-20.

Future Trends in Polynomial Optimization, Toulouse, France, November 13-17.

18 SIAM Annual Meeting and SIAM Conference on Applied Mathematics Education. Portland, July 9-13.

SELECTED RECENT SEMINAR PRESENTATIONS

25 *It is OK for dynamics to be multivalued, have nonunique solutions, and blend continuous time with discrete time*, Differential Equations and Harmonic Analysis Seminar, Department of Mathematics, University of Illinois Urbana-Champaign, February 18th.

24 *It is OK for dynamics to be multivalued and have nonunique solutions: from the leaky bucket ODE to the Conley decomposition and a total Lyapunov function for hybrid dynamics*, Center for Control, Dynamical Systems, and Computation, University of California Santa Barbara, February 2nd

23 *The Conley Decomposition for Hybrid Dynamical Systems*, Decision and Control Laboratory, University of Illinois Urbana-Champaign, February 21st

22 *Convex analysis approach to the consensus problem*, Decision and Control Laboratory, University of Illinois Urbana-Champaign, March 23rd (local support by organizers)

17 *Monotone Mappings in Saddle-Point Dynamics*, Decision and Control Laboratory, University of Illinois Urbana-Champaign

16 *Some Control Engineering Problems Where Convex and Set-Valued Analysis is Helpful*, Decision and Control Laboratory, University of Illinois Urbana-Champaign

Some Control Engineering Problems Where Convex and Set-Valued Analysis is Helpful, Electrical and Computer Engineering, Concordia University, Montreal

15 *Survey of Mathematical Models of Hybrid Systems*, School of Engineering, University of California Santa Cruz

Some Control Engineering Problems Where Convex and Set-Valued Analysis is Helpful, School of Engineering, University of California Santa Cruz

Brockett's necessary condition for asymptotic stability and controllability, Analysis Seminar, Department of Mathematics and Statistics, Loyola University Chicago

Robust Stability and Feedback Stabilization for Systems with a Continuum of Equilibria, Decision and Control Laboratory, University of Illinois Urbana-Champaign

14 *Convex conjugacy and Lyapunov functions*, Colloquium, Department of Mathematics, Western Michigan University

Convex conjugacy and Lyapunov functions, Colloquium, Applied Mathematics, Bayreuth University, Germany

Consensus, Continuum of Equilibria, Stability, and Set-Valued Lyapunov Functions, Aerospace and Mechanical Engineering, University of Arizona, Tucson

13 *Hybrid Dynamics and Control*, Northwestern Institute on Complex Systems, Northwestern University

PUBLICATIONS

Books:

2. R. Goebel, *Set-valued, Convex, and Nonsmooth Analysis in Dynamics and Control: an Introduction*, SIAM, 2024.

1. R. Goebel, A. Teel, and R. Sanfelice, *Hybrid dynamical systems. Modeling, stability, and robustness.*, Princeton University Press, 2012.

Refereed Journal Publications:

44. R. Goebel and A.R. Teel, *A smooth Conley-Lyapunov function for hybrid inclusions on* $\mathbb{R}^n$, Systems & Control Letters, accepted July 2025.

43. R. Goebel *A direct proof of Conley's decomposition for well-posed hybrid inclusions*, Systems & Control Letters, Volume 180, Paper No. 105604, 2023.

42. R. Goebel *Discrete-time switching systems as difference inclusions: deducing converse Lyapunov results for the former from those for the latter*, IEEE Transactions on Automatic Control, Volume 68, Number 6, 3694-3697, 2023.

41. M. Della Rossa, R. Goebel, A. Tanwani, and L. Zaccarian, *Piecewise structure of Lyapunov functions and densely checked decrease conditions for hybrid systems*, Mathematics of Control, Signals, and Systems, Volume 33, Number 1, 123–149, 2021.

40. R. Goebel and R.G. Sanfelice, *A unifying convex analysis and switching system approach to consensus with undirected communication graphs*, Automatica, Automatica, Volume 111, 108598, 7 pages, 2020.

39. R. Goebel, *Existence of optimal controls on hybrid time domains*, Nonlinear Analysis: Hybrid Systems, Volume 31, 153–165, 2019.

38. R. Goebel and R. Sanfelice, *Pointwise asymptotic stability in a hybrid system and well-posed behavior beyond Zeno*, SIAM Journal on Control and Optimization, Volume 56, Issue 2, 1358–1385, 2018.

37. R. Goebel, *Stability and robustness for saddle-point dynamics through monotone mappings*, Systems & Control Letters, Volume 108, 16–22, 2017.

36. R. Goebel, *Optimal control for pointwise asymptotic stability in a hybrid control system*, Automatica J. IFAC, Volume 81, 397–402, 2017.

35. R. Goebel, *Robustness of Stability Through Necessary and Sufficient Lyapunov-like Conditions for Systems with a Continuum of Equilibria*, Systems & Control Letters, Volume 65, 81–88, 2014.

34. R. Goebel, *Lyapunov functions and duality for convex processes*, SIAM Journal on Control and Optimization, Volume 51, Issue 4, 3332–3350, 2013.

33. E.N.Barron, R. Goebel, and R.R. Jensen, *Quasiconvex Functions and Nonlinear PDEs*, Transactions of the AMS, Volume 365, 4229–4255, 2013.

32. E.N.Barron, R. Goebel, and R.R. Jensen, *Functions which are quasiconvex under linear perturbations*, SIAM Journal on Optimization, Volume 22, Number 3, 1089–1108, 2012.

31. E.N.Barron, R. Goebel, and R.R. Jensen, *The quasiconvex envelope through first-order partial differential equations which characterize quasiconvexity of nonsmooth functions*, Discrete and Continuous Dynamical Systems, Series B, Volume 17, Issue 6, 1693–1706, 2012.

30. R. Goebel, W. Hare, X. Wang, *The optimal value and optimal solutions of the proximal average of convex functions*, Nonlinear Analysis: Theory, Methods & Applications, Volume 75, Issue 3, 1290–1304, 2012.

29. R. Goebel, *Set-valued Lyapunov functions for difference inclusions*, Automatica, Volume 47, Issue 1, 127–132, 2011.

28. R. Goebel, *The proximal average for saddle functions and its symmetry properties with respect to partial and saddle conjugacy*, Journal of Nonlinear and Convex Analysis, Volume 11, Number 1, 1–11, 2010.

27. E.N. Barron, R. Goebel, and R.R. Jensen, *Best response dynamics for continuous games*, Proceedings of the AMS, Volume 138, Issue 3, 1069–1083, 2010.

26. R. Goebel and A. Teel, *Pre-asymptotic stability and homogeneous approximation of hybrid dynamical systems*, SIAM Review, Volume 52, Issue 1, 87–109, 2010.

25. R. Goebel, C. Prieur, and A. Teel, *Smooth patchy control Lyapunov functions*, Automatica, Volume 45, 675–683, 2009.

24. R. Goebel and A. Teel, *Direct design of robustly asymptotically stabilizing hybrid feedback*, ESAIM: Control, Optimisation and Calculus of Variations, Volume 15, Number 1, 205–213, 2009.

23. C. Cai, R. Goebel, and A. Teel, *Relaxation theorems for hybrid inclusions*, Set-Valued Analysis, Volume 16, Issue 5, 733–757, 2008.

22. R. Goebel, R. Sanfelice, and A. Teel, *Invariance principles for switching systems via hybrid systems techniques*, Systems & Control Letters, Volume 57, Number 12, 980–986, 2008.

21. R. Sanfelice, R. Goebel, and A. Teel, *Generalized solutions to hybrid dynamical systems*, ESAIM: Control, Optimisation and Calculus of Variations, Volume 14, Number 4, 699–724, 2008.

20. H. Bauschke, R. Goebel, Y. Lucet, and X. Wang, *The proximal average: basic theory*, SIAM Journal on Optimization, Volume 19, Number 2, 766–785, 2008.

19. R. Goebel and R.T. Rockafellar, *Local strong convexity and local Lipschitz continuity of the gradient of convex functions*, Journal of Convex Analysis, Volume 15, Number 2, 263–270, 2008.

18. R. Goebel, *Self-dual smoothing of convex and saddle functions*, Journal of Convex Analysis, Volume 15, Number 1, 179–190, 2008.

17. C. Cai, A. Teel, and R. Goebel, *Smooth Lyapunov functions for hybrid systems. Part II: (Pre-)asymptotically stable compact sets*, IEEE Transactions on Automatic Control, Volume 53, Number 3, 734–748, 2008.

16. R. Sanfelice, R.Goebel, and A. Teel *Invariance principles for hybrid systems with connections to detectability and asymptotic stability*, IEEE Transactions on Automatic Control, Volume 52, Issue 12, 2282–2297, 2007.

15. C. Prieur, R. Goebel, and A. Teel, *Hybrid feedback control and robust stabilization of nonlinear systems*, IEEE Transactions on Automatic Control, Volume 52, Issue 11, 2103–2117, 2007.

14. C. Cai, A. Teel, and R. Goebel, *Smooth Lyapunov functions for hybrid systems. Part I: Existence is equivalent to robustness*, IEEE Transactions on Automatic Control, Volume 52, Issue 7, 1264–1277, 2007.

13. R. Goebel and M. Subbotin, *Continuous time constrained Linear Quadratic Regulator – convex duality approach*, IEEE Transactions on Automatic Control, Volume 52, Issue 5, 886–892, 2007.

12. R. Goebel, A. Teel, T. Hu, and Z. Lin, *Conjugate convex Lyapunov functions for dual linear differential inclusions*, IEEE Transactions on Automatic Control, Volume 51, Issue 4, 661–666, 2006.

11. R. Goebel and A. Teel, *Solutions to hybrid inclusions via set and graphical convergence with stability theory applications*, Automatica, Volume 42, Issue 4, 573–587, 2006.

10. T. Hu, A. Teel, R. Goebel, and Z. Lin, *Conjugate Lyapunov functions for saturated linear systems*, Automatica, Volume 41, Issue 11, 1949–1956, 2005.

9. R. Goebel, *Stabilizing a linear system with saturation through optimal control*, IEEE Transactions on Automatic Control, Volume 50, Issue 5, 650–655, 2005.

8. R. Goebel, *Duality and uniqueness of convex solutions to stationary Hamilton-Jacobi equations*, Transactions of the AMS, Volume 357, 2187–2203, 2005.

7. R. Goebel, *Convex optimal control problems with smooth Hamiltonians*, SIAM Journal of Control and Optimization, Volume 43, Number 5, 1787–1811, 2005.

6. R. Goebel, *Regularity of the optimal feedback and the value function in convex problems of optimal control*, Set-Valued Analysis, Volume 12, Issue 1-2, 127–145, 2004.

5. J. Borwein and R. Goebel, *Notions of relative interior in Banach spaces*, Journal of Mathematical Sciences, Volume 115, Issue 4, 2542–2553, 2003.

4. R. Goebel, *Planar generalized Hamiltonian systems with large saddle sets*, Journal of Nonlinear and Convex Analysis, Volume 3, Number 3, 365–380, 2002.

3. R. Goebel and R.T. Rockafellar, *Generalized conjugacy in Hamilton-Jacobi theory for fully convex Lagrangians*, Journal of Convex Analysis, Volume 9, Number 1, 463–473, 2002.

2. R. Goebel, *Convexity in zero-sum differential games*, SIAM Journal on Control and Optimization, Volume 40, Number 5, 1491–1504, 2002.

1. R. Goebel, *Sufficient condition for stability of an L^2-angle*, Bulletin of the Polish Academy of Science, Vol 45, No 3, 227–232, 1997.

Selected Refereed Conference Proceedings Contributions:

16. A.R. Teel, R.K. Goebel, and R.G. Sanfelice, *Stochastic approximation of differential inclusions: almost sure boundedness and asymptotic convergence*, 13th IFAC Symposium on Nonlinear and Control Systems, 2025.

15. A.R. Teel, R.K. Goebel, R.G. Sanfelice, and M.F. Crisafulli, *Stochastic approximation results for hybrid inclusions*, Proceedings of the 64th Conference on Decision and Control, 2024.

14. R. Goebel, R. Sanfelice, and A.R. Teel, *Some converse Lyapunov-like results for strong forward invariance*, Proceedings of the 63rd Conference on Decision and Control, 2024.

13. A.R. Teel and R. Goebel, *Stochastic approximations of hybrid systems with continuous flow maps*, 8th IFAC Conference on Analysis and Design of Hybrid Systems, 2024.

12. A.R. Teel, R. Goebel, and R.G. Sanfelice, *Multi-channel hybrid time domains and clustering protocols for large-scale interconnections*, Proceedings of the 62nd Conference on Decision and Control, 2023.

11. A.R. Teel, R. Goebel, B. Morris, A. Ames, J.W. Grizzle *A stabilization result with application to bipedal locomotion*, Proceedings of the 52nd Conference on Decision and Control, 2013.

10. R. Goebel *The Value Function for the Linear-Quadratic Regulator with Conical Control Constraints*, Proceedings of the 49th Conference on Decision and Control, 2010.

9. R. Goebel and A. Teel, *Zeno behavior in homogeneous hybrid systems*, Proceedings of the 47th Conference on Decision and Control, 2008.

8. R. Goebel and A. Teel, *Lyapunov characterization of Zeno behavior in hybrid systems*, Proceedings of the 47th Conference on Decision and Control, 2008.

7. R.T. Rockafellar and R. Goebel, *Linear-convex control and duality*, to appear in the Proceedings of the Geometric Control and Nonsmooth Analysis Conference, Rome 2006, Series on Advances in Mathematics for Applied Sciences.

6. R. Sanfelice, A. Teel, R. Goebel, and C. Prieur, *On the robustness to measurement noise and unmodeled dynamics of stability in hybrid systems*, Proceedings of the 2006 American Control Conference, 2006.

5. R. Sanfelice, R. Goebel, and A. Teel, *A feedback control motivation for generalized solutions to hybrid systems*, Hybrid Systems: Computation and Control: 9th International Workshop, HSCC 2006, Editors: J. Hespanha and A. Tiwari, Springer.

4. R. Goebel, A. Teel, T. Hu, and Z. Lin, *Dissipativity for dual linear differential inclusions through conjugate storage functions*, Proceedings of the 43nd IEEE Conference on Decision and Control, 2004.

3. R. Goebel, J. Hespanha, A. Teel, C. Cai, and R. Sanfelice, *Hybrid systems: generalized solutions and robust stability*, 6th IFAC Symp. on Nonlinear Contr. Systems, 2004.

2. D. Dačić, R. Goebel, and P. Kokotović, *A factorization approach to C^1 stabilization of nonlinear triangular systems*, Proceedings of the 42nd IEEE Conference on Decision and Control, Maui, 2003.

1. R. Goebel, *Stationary Hamilton-Jacobi equations for convex control problems — uniqueness and duality of solutions*, Optimal Control, Stabilization, and Nonsmooth Analysis; de Queiroz, M., M. Malisoff, and P. Wolenski, Editors; Lecture Notes in Control and Information Sciences, Springer-Verlag, 2004.

Other Contributions:

10. R. Goebel, *A glimpse at pointwise asymptotic stability for continuous-time and discrete-time dynamics*, Splitting Algorithms, Modern Operator Theory, and Applications, eds. H. Bauschke,R. Burachik, and R. Luke, Springer, 2019.

9. R. Goebel and S. Raković, *Set-valued and Lyapunov methods for MPC*, Handbook of Model Predictive Control, eds. S. Raković and W. Levine, Springer, 2018.

8. J. Borwein and R. Goebel, *On the nondifferentiability of cone-monotone functions in Banach spaces*, Optimization: Structure and Applications, E. Hunt and C. Pearce editors, Optimization and Its Applications, Volume 32, 3–14, Springer, 2009.

7. R. Goebel, R. Sanfelice, and A.R. Teel, *Hybrid dynamical systems. Robust stability and control for systems that combine continuous-time and discrete-time dynamics*, IEEE Control Systems Magazine, Volume 29, Issue 2, 28–93, 2009.

6. A.R. Teel, R. Sanfelice, and R. Goebel *Hybrid control systems*, Encyclopedia of Complexity and Systems Science, R.A. Meyers, Editor, Springer, 2009.

5. C. Cai, R. Goebel, R. Sanfelice, and A.R. Teel, *Hybrid systems: limit sets and zero dynamics with a view toward output regulation*, Analysis and Design of Nonlinear Control Systems. In Honor of Alberto Isidori, 237–257, Springer-Verlag, 2007.

4. R. Goebel, T. Hu, and A.R. Teel, *Dual matrix inequalities in stability and performance analysis of linear differential/difference inclusions*, Current trends in nonlinear systems and control, 103–122, Systems Control Found. Appl., Birkhauser Boston, Boston, MA, 2006.

3. R. Goebel, *Convexity, Convergence and Feedback in Optimal Control*, Doctoral Dissertation, Department of Mathematics, University of Washington, 2000.

2. R. Goebel, *Convexity and Hamiltonian equations in differential games*, Interim Report, International Institute for Applied Systems Analysis, August 1998.

1. R. Goebel, *On the Stability of an L^2-angle*, Masters Thesis (in Polish), Department of Mathematics, University of Maria Curie-Sklodowska, Lublin, Poland, 1994.

Submitted Contributions:

2. A.R. Teel, R.G. Sanfelice, and R.K. Goebel, *Stochastic approximation of hybrid systems: boundedness and asymptotic behavior*, submitted January 2025, revised and resubmitted June 2025.

1. R. Goebel, A.R. Teel, and R.G. Sanfelice *Lyapunov-like descriptions of strong forward invariance for differential inclusions*, submitted February 2025.