

Publications
Richard Rebarber
November 2005

Publications in Refereed Journals:

1. A Laplace Transform Relevant to Holomorphic Semigroups, *The Proceedings of the Royal Society of Edinburgh*, **105A** (1987), pp. 243-258.
2. Canonical Forms for a Class of Distributed Parameter Control Systems, *SIAM Journal on Control and Optimization*, **26**, No. 6 (1988) pp. 1362-1387.
3. Spectral Assignability for Distributed Parameter Systems with Unbounded Scalar Control, *SIAM Journal on Control and Optimization*, **27**, No. 1, (1989) pp. 148-169.
4. Spectral Determination for a Cantilever Beam, *IEEE Transactions on Automatic Control*, **34**, No. 5 (1989) pp. 502-510.
5. Necessary Conditions for Exponential Stabilizability of Distributed Parameter Systems with Infinite-Dimensional Unbounded Feedback, *Systems and Control Letters*, **14**, No. 3 (1990) pp. 241-248.
6. Semigroup Generation and Stabilization by A^p -bounded Perturbations, *Systems and Control Letters*, **14**, No. 4 (1990) pp. 333-340.
7. Conditions for the Equivalence of Internal and External Stability for Distributed Parameter Systems, *IEEE Transactions on Automatic Control*, **38**, No. 6 (1993) pp. 994-998.
8. Exponential Stability of Coupled Beams with Dissipative Joints: a Frequency Domain Approach, *SIAM J. on Control and Optimization*, **33**, No. 1 (1995) pp. 1-28.
9. (with S. Townley) Robustness and Continuity of the Spectrum for Uncertain Distributed Parameter Systems, *Automatica*, **31**, No. 11 (1995) pp. 1533-1546.
10. (with H. Logemann and G. Weiss) Conditions for Robustness and Nonrobustness of the Stability of Feedback Systems with Respect to Small Delays in the Feedback Loop, *SIAM Journal on Control and Optimization*, **34**, No. 2 (1996), pp. 572-600.
11. (with H. Logemann) The Effect of Small Time-Delays on the Closed-Loop Stability of Boundary Control Systems, *Mathematics of Control, Signals and Systems*, **9** (1996), p. 123-151.
12. (with S. Townley) Stabilization of Distributed Parameter Systems by Piecewise-Polynomial Control, *IEEE Trans. on Automatic Control*, **42** (1997), pp. 1254-1257.
13. (with H. Zwart) Open Loop Stabilizability of Infinite-Dimensional Systems, *Mathematics of Control, Signals and Systems* **11** (1998), pp. 129-160.

14. (with H. Logemann) PDEs with Distributed Control and Delay in the Loop: Transfer Function Poles, Exponential Modes, and Robustness of Stability, *European Journal of Control* **4** (1998), pp. 333-344.
15. (with S. Townley) Robustness with Respect to Delays for Exponential Stability of Distributed Parameter Systems, *SIAM Journal on Control and Optimization* **37** (1999), pp. 230-244.
16. (with S. Townley) Generalized Sampled-Data Feedback Control of Distributed Parameter Systems, *Systems and Control Letters* **34** (1998) pp. 229-240.
17. (with G. Avalos and I. Lasiecka) Lack of Time-Delay Robustness for Stabilization of a Structural Acoustics Model, *SIAM Journal on Control and Optimization* **37** (1999), pp. 1394-1418.
18. (with G. Weiss) Necessary Conditions for Exact Controllability with a Finite-Dimensional Input Space, *Systems and Control Letters* **40** (2000) pp. 217-227.
19. (with G. Weiss) Optimizability and Estimatability for Infinite-Dimensional Linear Systems, *SIAM Journal on Control and Optimization* **39** (2000) pp. 1204-1232.
20. (with G. Avalos and I. Lasiecka) Well-Posedness of a Structural Acoustics Model with Point Observation of the Pressure, *Journal of Differential Equations* **173** (2001) pp. 40-78.
21. (with G. Avalos and I. Lasiecka) Uniform Decay Properties of a Structural Acoustics Model, *Journal de Mathématiques Pures Et Appliquées* **79**, 10 (2000), pp. 1057-1072.
22. (with H. Logemann and S. Townley), Stability of Infinite Dimensional Sampled Data Systems, *Trans. American Mathematical Society*, **355**, No. 8 (2003), pp. 3301-3328.
23. (with S. Townley) Non-Robustness of Closed-loop Stability for Infinite-Dimensional Systems Under Sample and Hold, *IEEE Transactions on Automatic Control* **47**, no. 8 (2002), 1381-1385.
24. (with G. Weiss) Internal Model Based Tracking and Disturbance Rejection for Stable Well-Posed Systems, *Automatica*, **39** (2003), pp. 1555-1569.
25. (with G. Avalos and I. Lasiecka) Boundary Controllability of a Coupled Wave/Kirchoff System, *Systems & Control Letters*, **50** (2003), pp. 331-341.
26. (with H. Logemann and S. Townley) Generalized sampled-data stabilization of well-posed linear infinite-dimensional systems, *SIAM J. Control and Optimization*, **44**, 4 (2005), pp. 1345-1369.
27. (with S. Townley) Robustness with Respect to Sampling for Stabilization of Riesz Spectral Systems, accepted subject to minor revision to *IEEE Trans. Automatic Control*.

28. (with K. Morris) Feedback Invariance of SISO Infinite-Dimensional Systems, submitted to *Mathematics of Control, Signals and Systems*.

Papers in Preparation

- I.1 (with J. Azzam, J. Windle) Small Time Behavior of a Class of C_0 - Semigroups, with an Application to Sampled-Data Control.
- I.2 (with J. Azzam and J. Windle) Robustness with Respect to Sampling for a Feedback-Stabilized Beam Equation.
- I.3 (with Stuart Townley) Sampled-Data Control of Infinite-Dimensional Systems - a Survey.
- I.4 (with B. Tenhumberg, S. Townley, A. Tyre, J. Lubben, D. Boeckner, A. Dienes, A. Keighley, E. Peterson, R. Ryan, J. Boyle) The effect of uncertain data on a falcon population, in progress.
- I.5 (with J. Lubben, A. Keighley, B. Tenhumberg, S. Townley, A. Tyre, D. Boeckner, A. Dienes, E. Peterson, R. Ryan, J. Boyle) A new approach to cheetah conservation: headstarting using a matrix model, in progress.

Proceedings Publications:

- P1. Control Canonical Forms for a Class of Infinite-Dimensional Distributed Parameter Systems, presented at the 19th Conference on Information Sciences and Systems, Johns Hopkins University, March 1985; paper published in conference proceedings, pp. 630-635.
- P2. Eigenvalue Specification Using Feedback for a Class of Infinite-Dimensional Control Systems, in *Structural Control*, H.H.E. Leipholz, ed., Martinus Nyhoff, Publishers, Dordrecht, Netherlands, 1987, pp. 530-563. Paper presented at the 2nd International Symposium on Structural Control, Waterloo, Ontario, June, 1985.
- P3. Spectral Assignability for Distributed Parameter Systems, Proceedings of the 26th IEEE Conference on Decision and Control, Los Angeles, December 1987, pp. 1568-1569.
- P4. Conditions for Stabilizability of Distributed Parameter Systems, Proceedings of the 27th IEEE Conference on Decision and Control, Austin, Texas, December 1988, pp. 369-372.
- P5. Stability of Distributed Parameter Systems with Unbounded Controls, Preprints for The Fifth IFAC Symposium on Control of Distributed Parameter Systems, Perpignan, France, June 1989, pp. 123-128.
- P6. (with G. Weiss) Robustness of Distributed Systems with Respect to Small Time Delays, Proceedings of the 29th IEEE Conference on Decision and Control, Honolulu, Hawaii, December 1990.

- P7. Frequency Domain Methods for Proving the Uniform Stability of Vibrating Systems, Proceedings of the INRIA Conference on Control of Distributed Parameter Systems, Sophia-Antipolis, France, June 1992.
- P8. (with H. Logemann and G. Weiss) Conditions for Robustness of the Stability of SISO Feedback Systems With Respect to Small Delays in the Feedback Loop, Proceedings of the 1993 MTNS Symposium, Regensburg, Germany, pp. 769-773.
- P9. (with S. Townley) High Gain Robustness of Distributed Parameter Systems, Proceedings of the 1993 MTNS Symposium, Regensburg, Germany, pp. 835-838.
- P10. (with H. Zwart) Open Loop Stabilizability of Unitary Groups, Proceedings of 1993 European Control Conference, Groningen, the Netherlands, pp.1100-1104.
- P11. (with H. Logemann and G. Weiss) Destabilization of Multivariable Infinite-Dimensional Feedback Systems by Small Time Delays in the Loop, accepted to the Proceedings of the 1993 MTNS Symposium, Regensburg, Germany.
- P12. (with R. Moyer) Robustness with Respect to Delays for Stabilization of Diffusion Equations, Proceedings of the 3rd IEEE Mediterranean Symposium on New Directions in Control and Automation, Limassol, Cyprus, July 1995, pp. 24-29.
- P13. (with H. Zwart), Interpolation Theory for Control of Infinite-Dimensional Systems, Proceedings of the 2nd International Symposium on Methods and Models in Automation and Robotics, August 1995, Międzyzdroje, Poland, pp. 43-48.
- P14. (with H. Logemann) The Effect of Small Time-Delays on the Stability of Boundary Control Feedback Systems, Proceedings of the 3rd European Control Conference, Rome, Italy, September 1995, pp. 3304-3309.
- P15. (with S. Townley, D. Oates and H. Zwart) Stabilization of Infinite-Dimensional Systems by Generalized Sampled-Data Control, Proceedings of the 3rd International Symposium on Methods and Models in Automation and Robotics, August 1998, Międzyzdroje, Poland, pp. 127-132.
- P16. (with G. Weiss) An Extension of Russell's Principle on Exact Controllability, Proceedings of the 1997 European Control Conference, available on CD-ROM.
- P17. (with G. Weiss) Estimatable Linear Systems, Proceedings of the 1997 European Control Conference, available on CD-ROM.
- P18. (with G. Weiss) Lack of exact controllability with finite-dimensional input spaces, Proceedings of the 5th International Symposium on Methods and Models in Automation and Robotics, August 1998, Międzyzdroje, Poland, pp. 69-74.
- P19. (with G. Weiss) Dynamic stabilizability of well-posed linear systems, Proceedings of the 5th International Symposium on Methods and Models in Automation and Robotics, August 1996, Międzyzdroje, Poland, pp. 91-98.

- P20. (with G. Weiss) Low gain tracking for well-posed systems, Proceedings of the 2000 MTNS Symposium, Perpignan, France.
- P21. (with S. Townley) Robustness of distributed parameter systems with respect to sample and hold - counterexamples, Proceedings of the 2000 Conference on Decision and Control Sydney, Australia.
- P22. (with K. Morris) Zeros of SISO infinite dimensional systems, Proceedings of the 2002 MTNS Symposium, Notre Dame, paper available at <http://www.nd.edu/mtns/papers/20828-6.pdf>.
- P23. (with J. Azzam and J. Windle) Sampled-Data Feedback Stabilization of a Beam Equation with Boundary Control, Proceedings of the 2004 MTNS Symposium, Leuven, Belgium, paper available at <http://www.esat.kuleuven.ac.be/cghgate/mtns/conf.jsp>
- P24. (with K. Morris) Feedback-Invariant Subspaces in Infinite-Dimensional Systems, accepted to the Proceedings of the 2005 Conference on Decision and Control.

Undergraduate Research Activities

REU Site Projects:

From 6/10/03 - 8/3/03 I supervised an REU Site project on *Sampled Data Control*, with undergraduates Ian Grooms, Kyle Hays, Jonas Azzam and Greg Norgard, and participation from graduate students Gretchen Bartels and Bobbie Carlstrom. This project resulted in the paper *A Nonstandard Fourier Inequality*, Rose-Hulman Undergraduate Mathematics Journal **6** (1), 2005.

From 6/5/05 - 7/29/05 I co-supervised an REU Site project, with Professors Brigitte Tenhumberg (Biology) and Andrew Tyre (Natural Resources), in *Control Theory Techniques Applied to Ecological Problems*. The undergraduates were Joy Kogut, Richard Ryan, Ellen Peterson, James Boyle, Derek Boekner, Alyson Dienes and Amy Keighley, with participation from graduate student Joan Lubben. This project resulted in two papers in progress.

Other Undergraduate Research Training: In the Spring Semester of 2005 I designed and taught a pilot course on "Introduction to Mathematics Research for Undergraduates". I have written two grant proposals to University of Nebraska Educational Initiatives for continued funding for this course.

Honors Theses Supervision: Since 1991 I have supervised nine undergraduate theses projects in topics related to my research, seven of them partially supported by the National Science Foundation. These students, the dates they worked, and their thesis titles, are:

Barry Ostmann: 1/91 - 5/92, *Asymptotic Formulas for the Eigenvalues of a Partial Differential Equation*.

Kevin Keyes: 1/93 - 5/94, *Steering Problems for Damped Beam Equations*.

Ann Nelson: 9/93 - 5/94, *Analysis of Transfer Functions for Vibrating Systems*.

Steve Whalen: 1/97-5/98, *Stability and Robustness for the Wave Equation with Boundary Feedback*, co-supervised with Professor Tom Shores.

Mustafa Bashir: 1/99 - 8/00, *Spectrum Behavior for Large-Dimension Sampled-Data Systems*.

Deborah Zadina: 1/99 - 12/00, *Acceptable Sampling Times for Sampled-Data Stabilization*.

Hoai Nam Tran: 1/00 - 12/01, *Low-Gain Tracking for Finite Dimensional Systems*.

Jesse Windle: 8/03 - 5/05, *Sampled-Data Control of a Beam Equation*.

Jonas Azzam: 8/03 - 5/05, thesis to be completed in the Spring of 2006.

NSF Research Experience for Undergraduates (REU) Supplements were obtained for Mr. Keyes, Ms. Nelson and Ms. Zadina. Mr. Whalen, Mr. Bashir, Mr. Azzam (summer only) and Mr. Windle (summer only) were paid from REU money in my regular NSF grant. Ms. Tran, Mr. Azzam and Mr. Windle were funded by the University of Nebraska UCARE program.

External Grants:

Air Force Office of Scientific Research:

AFOSR-86-0079 from 4/1/86 to 3/31/88, \$25,722

AFOSR-88-0230 from 8/1/88 to 7/31/90, \$30,462

National Science Foundation:

DMS-9206986 from 7/1/92 to 6/30/95, \$23,403 for the first year; \$24,333 for the second year and \$25,313 for the third year; REU supplements of \$3200 and \$2000

DMS-9623392 from 8/15/96 to 6/30/00, \$ 15,911 for the first year; \$16,542 for the second year, and \$15,690 for the third year; REU supplement of \$2,050

NSF-CBMS Regional Research Conference from 2/1/99 to 9/30/99, \$27,708

Research Experience for Undergraduates Site, co-PI, from 4/1/02 to 3/31/04, \$125,404

DMS-0206951 from 7/1/02 to 6/30/06, \$24,864 for the first year; \$24,858 for the second year and \$25,454 for the third year

Research Experience for Undergraduates Site, co-PI, from 4/1/04 to 3/31/07, \$223,987

NATO:

Collaborative Research Grant (with S. Townley and H. Logemann), Project Coordinator, from 5/1/95 to 9/30/96, \$6,234

Collaborative Research Grant (with S. Townley and H. Logemann), Project Coordinator, from 12/1/96 to 7/31/98, \$6,120

EPSRC (United Kingdom):

Visiting Fellowship (with S. Townley and H. Logemann), travel support from June 2002 to September 2004.

I am also co-PI (with Judy Walker, Allan Donsig and Wendy Hines) on grants from the NSF and NSA which fund the Conference for Undergraduate Women in Mathematics. We currently have a \$45,000, three year grant from the NSF and an \$18,000, one year grant from the NSA.