Roy Howard Goodman
goodman@njit.edu
http://web.njit.edu/~goodman

Associate Professor
Department of Mathematical Sciences
New Jersey Institute of Technology
Newark, NJ 07102
(973) 642-4261

Roy Goodman

Education

Formal

1994-1999 • Courant Institute of Mathematical Sciences, New York University, New York, NY
Ph.D. Mathematical Sciences (David W. McLaughlin, dissertation advisor)

1990-1994 • University of Michigan, Ann Arbor, MI
B.S. Mathematics (honors option), with highest honors

Additional

7/1996 • Summer School on Nonlinear Waves, Patterns, and Oscillations (Cork, Ireland)

Research Interests

- Linear and nonlinear wave propagation, PDE
- Dynamical Systems, Invariant Manifold Computations
- Mathematical modeling and asymptotic analysis of physical systems
- Nonlinear phenomena in optics
- Numerical Simulation

Professional Experience

2008– • **Associate Professor (Tenured)** New Jersey Institute of Technology

2002–2008 • **Assistant Professor** New Jersey Institute of Technology

2001–2002 • **Visiting Assistant Professor** New Jersey Institute of Technology

1999-2001 • **Visiting Research Fellow** Princeton University and Bell Laboratories (Lucent), under NSF University-Industry Cooperative Research Program in the Mathematical Sciences (advisors Philip Holmes, Princeton and Michael Weinstein, Bell Labs)

Visiting Positions

2018–2019 • **Long Term Visitor** Department of Mechanical Engineering, NYU Tandon School of Engineering

Fall 2016 • **Long Term Visitor** Institute for Mathematics and Applications, University of Minnesota

2010–2011 • **Visiting Associate Professor** Department of Mathematics, Technion Israel Institute of Technology

Scholarly Activities

Refereed Journal Papers

2020 • T. E. Faver, R. H. Goodman, and J. D. Wright, *Solitary Waves in Mass-in-Mass Lattices*, to appear in ZAMP.

2020 • A. Sagiv, A. Ditkowski, R. H. Goodman, and G. Fibich, *Loss of Physical Reversibility in Reversible Systems*, Phys. D 404, 132515.

2019 • B. M. Behring and R. H. Goodman, *Stability of Leapfrogging Vortex Pairs: A Semi-analytic Approach*, Phys. Rev. Fluids 4, 124703.

2019 • R. H. Goodman and M. Porfiri, *Topological features determining the error in the inference of networks using transfer entropy*, Math. in Engineering 2, 34–54.

2019 • A. Kairzhan, D. E. Pelinovsky, and R. H. Goodman, *Instability drift of shifted states on balanced star graphs*, SIAM J. Appl. Dyn Sys. 18, 1723-1755

2019 • R. H. Goodman, *NLS Bifurcations on the bowtie combinatorial graph and the dumbbell metric graph*, Disc. Cont. Dyn. Syst. 30, 2203–2232.

2017 • R. H. Goodman, *Bifurcations of relative periodic orbits in NLS/GP with a triple-well potential*, Phys. D 359, 39–59.

2015 • R. H. Goodman, P. G. Kevrekidis, R. Carretero, *Dynamics of vortex dipoles in anisotropic Bose-Einstein condensates*, SIAM J. Appl. Dyn. Sys. 14, 699–709.

2015 • R. H. Goodman, A. Rahman, M. Bellanich, C. Morrison, *A mechanical analog of the two-bounce resonance of solitary waves: Modeling and experiment*, Chaos 25, 043109

2015 • R. H. Goodman, J. L. Marzuola, and M. I Weinstein, *Self-trapping and Josephson tunneling solutions to the nonlinear Schrödinger / Gross-Pitaevskii Equation*, Disc. Cont. Dyn. Sys. 35, 225–246.

2013 • J. K. Wróbel and R. H. Goodman, *High-order Adaptive Method for Computing Two-dimensional Invariant Manifolds of 3-D Maps*, Comm. Nonlin. Sci. and Num. Simul., 18 1734–1745.

2011 • R. H. Goodman, *Hamiltonian Hopf bifurcations and dynamics of NLS/GP standing-wave modes*, J. Phys. A: Math. Theor. 44 425101 (28pp).

2011 • R. H. Goodman and J. K. Wróbel, *High-order Bisection Methods for Computing Invariant Manifolds of 2-D Maps*, Int. J. Bifurcations and Chaos, 21, 2017–2042.

2009 • J. Bławzdziewicz, R. H. Goodman, N. Khurana, E. Wajnryb, and Y.-N. Young, *Nonlinear hydrodynamic phenomena in the Stokes flow regime*, Phys. D, 239, 1214–1224.

2008 • Y.-N. Young, J. Bławzdziewicz, V. Cristini, and R. H. Goodman, *Hysteretic and chaotic dynamics of viscous drops in creeping flows with rotation*, J. Fluid Mech., 607 (2008), 209–234.

2008 • R. H. Goodman, *Chaotic scattering in solitary wave interactions: A singular iterated-map description*, Chaos, 18 (2008), 023113.

2008 • R. H. Goodman and M. I. Weinstein, *Stability and instability of nonlinear defect states in the coupled mode equations—analytical and numerical study*, Phys. D, 237 (2008), 2731-2760.

2007 • R. H. Goodman and R. Haberman, *Chaotic Scattering and the* n*-bounce Resonance in Solitary Wave Interactions*, Phys. Rev. Lett., 98 (2007) 104103 1–4.

2005 • R. H. Goodman and R. Haberman, *Kink-antikink collisions in the ϕ^4 equation: The* n*-bounce resonance and the separatrix map*, SIAM J. Appl. Dyn. Sys., 4 (2005) 1195–1128.

2005 • R. H. Goodman and R. Haberman, *Vector soliton interactions in birefringent optical fibers,* Phys. Rev. E 71 (2005) 056606.

2004 • R. H. Goodman, R. Haberman, *Interaction of sine-Gordon kinks with defects: The two-bounce resonance*, Phys. D, 195 (2004) 303–323.

2004 • R. H. Goodman, P.J. Holmes, and M.I. Weinstein, *Strong NLS soliton-defect interactions*, Phys. D, 192 (2004), pp 215–248.

2002 • R. H. Goodman, R. E. Slusher, and M.I. Weinstein, *Stopping light on a defect*, J. Opt. Soc. Am. B., **19**, 2002, pp. 1635–1652.

2002 • R. H. Goodman, P.J. Holmes, and M.I. Weinstein, *Interaction of sine-Gordon kinks with defects: Phase space transport in a two-mode model*, Physica D **161**, (2002) pp. 21–44.

2001 • R. H. Goodman, A.J. Majda, and D.W. McLaughlin, *Modulations in leading edges of midlatitude storm tracks* SIAM J. Appl. Math **62**, (2001), pp. 746–776.

2001 • R. H. Goodman, M.I. Weinstein, and P.J. Holmes, *Nonlinear propagation of light in one-dimensional periodic structures*, Journal of Nonlinear Science, **11**, (2001), pp 123–168.

1995 • R. H. Goodman, D.S. Graff, L.M. Sander, P. Leroux-Hugon, and E. Clement, *Trigger waves in a model for catalysis* Phys. Rev. E. **52**, (1995), pp. 5904–5909.

Scholarly Activities (continued)

Book Chapters

2019 • R. H. Goodman, *Mathematical analysis of fractal kink-antikink collisions in the ϕ^4 model* in **A dynamical perspective on the ϕ^4 model**, Springer, P. G. Kevrekidis and J. Cuevas-Maraver, eds.

Unrefereed Proceedings Publications

2005 • R. H. Goodman, R. E. Slusher, M.I. Weinstein and M. Klaus, *Trapping light with grating defects* **Mathematical Methods for Nonlinear Wave Propagation**, Contemp. Math **379**, (2005), pp. 83–92.

2005 • P.J. Holmes, R. H. Goodman and M.I. Weinstein, *Trapping of kinks and solitons by defects: Phase space transport in finite dimensional models*, Proceedings of the International Conference on Progress in Nonlinear Science dedicated to Alexander Andronov, Nizhny Novgorod, Russia, July 2001.

Book Reviews

2017 • Review of *Methods of Mathematical Modeling* by Witelski and Bowen, SIAM Review **60** (2018), pp. 215–216.

Other Unrefereed Writing

2019 • Four Decades of Kink Interactions in Nonlinear Klein-Gordon Models: A Crucial Typo, Recent Developments and the Challenges Ahead, to appear on DSWeb, a website of the SIAM Activity Group in Dynamical Systems

2019 • *Markdown: A Writing Tool for Every Applied Mathematician's Toolbox*, SIAM News, May 2019.

Teaching Publications

2007 • B. Bukiet and R. H. Goodman, Methods of Applied Mathematics (sample honors syllabus), Honors in Practice, 3, (2007) 171–175.

Conference Presentations, invited

12/2019 • Canadian Mathematical Society Winter Meeting, Toronto, ON, invited speaker in session on Symmetry in Dynamical Systems

4/2019 • The Eleventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, minisymposium speaker

10/2018 • AMS Sectional Conference, Ann Arbor, MI, special session speaker

6/2018 • SIAM Conference on Nonlinear Waves and Coherent Structures, Anaheim, CA, minisymposium speaker

8/2017 • Applied Mathematics, Modeling and Computational Science (AMMCS), Waterloo ON, minisymposium speaker

5/2017 • SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, minisymposium speaker

10/2016 • Workshop on Mathematical and Physical Models of Nonlinear Optics, Institute for Mathematics and applications, Minneapolis, MN, invited speaker

6/2016 • Coherent Structures in PDEs and Their Application, Oaxaca, MX, invited speaker

7/2015 • Workshop on Pattern Formation, Dalhousie University, Halifax, NS, invited speaker

6/2015 • International Conference on Mathematics of Nonlinearity in Neural and Physical Science, Shanghai, China, invited speaker

8/2014 • SIAM Conference on Nonlinear Waves and Coherent Structures, Cambridge, UK, minisymposium speaker

5/2013 • Frontiers in Applied Mathematics, Newark, NJ, minisymposium speaker

5/2013 • SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, featured minisymposium speaker

7/2012 • 2nd Conference on Localized Excitations in Nonlinear Complex Systems (LENCOS'12), Seville, Spain

4/2012 • Nonlinear Waves: Asymptotic Theory and Applied Mathematics, Mexico City, MX, invited presentation

11/2011 • SIAM Conference on Analysis of Partial Differential Equations, San Diego, CA, invited minisymposium speaker

Scholarly Activities (continued)

8/2010 • SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA, minisymposium speaker
8/2009 • Analysis of nonlinear wave equations and applications in engineering, Banff International Research Station, Alberta, Canada, invited participant and speaker in 5-day workshop
5/2008 • Seventh AIMS Conference on Dynamical Systems and Differential Equations, Arlington, TX, minisymposium speaker
3/2008 • AMS Sectional Meeting, New York, NY, minisymposium speaker
5/2007 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, minisymposium speaker
4/2007 • AMS Sectional Meeting, Hoboken, NJ, minisymposium speaker
12/2006 • CMS Winter Meeting, Toronto, ON, minisymposium speaker
9/2006 • SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, minisymposium speaker
7/2006 • SIAM Annual Meeting, Boston, MA, minisymposium speaker
5/2005 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, minisymposium speaker
4/2005 • IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, minisymposium speaker
10/2004 • SIAM Conference on Nonlinear Waves and Coherent Structures, Orlando, FL, minisymposium speaker
7/2004 • Workshop on Mathematical Ideas in Nonlinear Optics, Edinburgh, UK, invited 30-minute talk.
10/2003 • AMS Sectional Meeting, Chapel Hill, NC, minisymposium speaker
7/2002 • SIAM 50th anniversary Conference, Philadelphia, PA, minisymposium speaker

Conference Presentations, Contributed

6/2012 • SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, contributed talk
7/2011 • 10th International Conference on the Mathematical and Numerical Aspects of Waves, Vancouver, BC, contributed talk (refereed)
5/2010 • Frontiers in Applied Mathematics, Newark, NJ, minisymposium speaker and poster
5/2009 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, poster with graduate student J. Wróbel
2/2009 • SIAM Conference on Computational Science and Engineering, Miami, FL, poster with graduate student J. Wróbel
7/2008 • SIAM Conference on Nonlinear Waves and Coherent Structures, Rome, Italy, contributed talk
5/2007 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
5/2006 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
10/2005 • International Workshop on Applied Dynamical Systems. Centre des Recherches Mathematiques, Montreal, QC, Canada, poster
5/2005 • Frontiers in Applied and Computational Mathematics, Newark, NJ, contributed poster
10/2004 • Conference in honor of D. McLaughlin's 60th birthday, Chapel Hill, NC, poster
5/2004 • Frontiers in Applied and Computational Mathematics, Newark, NJ, poster
1/2004 • Dynamics Days, Chapel Hill, NC, poster
5/2003 • SIAM Conference on Application of Dynamical Systems, Snowbird, UT, contributed talk
5/2002 • NSF-CBMS Regional Research Conference on Mathematical Methods for Nonlinear Wave Propagation, North Carolina A&T State University, poster.

Other Significant Talks

3/2020 • Mathematical Physics Seminar, Yeshiva University (scheduled)
2/2020 • Applied Mathematics Colloquium, New Jersey Institute of Technology
3/2019 • Applied Math Seminar, Drexel University
10/2018 • Analysis and PDE Seminar, University of North Carolina
4/2018 • Mathematics Seminar, University of Vermont
2/2017 • AIMS Seminar, University of Michigan
9/2016 • IMA Visitors Seminar, University of Minnesota
3/2015 • Math Department Seminar, Southern Methodist University
5/2014 • Dynamical Systems Seminar, Mechanical Engineering, NYU Polytechnic Institute
4/2014 • Mathematics Seminar, Montclair State University
4/2014 • Computational and Applied Mathematics Seminar, Rutgers University

Scholarly Activities (continued)

3/2013 • Center for Computational Science Seminar, Tulane University
1/2013 • Applied Math Seminar, Drexel University
3/2012 • Center for Applied Mathematics Seminar, University of Massachusetts
12/2010 • Solid State Center Colloquium (Physics), Technion Israel Institute of Technology
11/2010 • Applied Math Seminar, Weizmann Institute, Rehovot Israel
10/2010 • Applied Math Colloquium, Tel Aviv University
10/2010 • Applied Math and PDE Seminar, Technion Israel Institute of Technology
3/2009 • Mathematics Colloquium, University at Buffalo
1/2009 • Dynamical Systems Seminar, Drexel University
12/2007 • Lefschetz Center for Dynamical Systems seminar, Brown University
11/2007 • Dynamical Systems and Nonlinear Science Colloquium, Georgia Tech
2/2007 • Dynamical Systems and Nonlinear Science Seminar, Princeton University
11/2006 • Applied Mathematics Colloquium, Columbia University
2/2004 • Dynamical Systems and Nonlinear Science Seminar, Princeton University
9/2004 • Mathematics Colloquium, University of Vermont
10/2002 • Mathematics Colloquium, Southern Methodist University
2/2002 • Mathematics Colloquium, Worcester Polytechnic Institute
1/2002 • Mathematics Colloquium, Drexel University
12/2001 • Mathematics Collquium, University of Maryland Baltimore County
11/2001 • Lefschetz Center for Dynamical Systems seminar, Brown University
10/2001 • Applied Mathematics Colloquium, NJIT

Conferences and Minisymposia Organized

2015 • Organizing Committee, Conference on Waves, Spectral Theory and Applications, Princeton, NJ, September 2015
2014 • Organizing Committee & two Minisymposia, Frontiers in Applied and Computational Mathematics, Newark, NJ, May, 2014
2013 • Minisymposium, Frontiers in Applied and Computational Mathematics, Newark, NJ, May, 2013
2010 • Organizing Committee, SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA, August 2010
2010 • Minisymposium, SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA, August 2010
2010 • Special Session, AMS Spring Eastern Meeting, Newark, NJ, May 2010
2008 • Special Session, AMS Spring Eastern Meeting, New York, NY, March 2008
2007 • Minisymposium, SIAM Conference on Application of Dynamical Systems, Snowbird, UT, May, 2007
2007 • Minisymposium, Frontiers in Applied and Computational Mathematics, Newark, NJ, May, 2007
2005 • Minisymposium, SIAM Conference on Application of Dynamical Systems, Snowbird, UT, May, 2005
2005 • Minisymposium, Frontiers in Applied and Computational Mathematics, Newark, NJ, May, 2005
2005 • Minisymposium, IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA, April, 2005
2004 • Organizer, Conference in honor of D. McLaughlin's 60th birthday, Chapel Hill, NC, October, 2004
2004 • Minisymposium, Frontiers in Applied and Computational Mathematics, Newark, NJ, May, 2004

Other Workshop Participation

2014 • The Thirtieth Annual Workshop on Mathematical Problems in Industry, NJIT, Newark, NJ, June, 2014

Grants

2008–2013 • Principal Investigator, Nonlinear waves and dynamical systems, NSF DMS–0807284, $199,881
2007–2009 • Co-Principal Investigator, **CSUMS:** Research and Education in Computational Mathematics for Undergraduates in the Mathematical Sciences at NJIT, NSF DMS-0639270, $536,696
2005–2008 • Principal Investigator, Mathematical methods for wave interactions, NSF DMS-0506495, $85,000
2004-2007 • Investigator, Acquisition of computer cluster for the Center of Applied Mathematics and Statistics at NJIT, NSF DMS–040590, Major Research Instrumentation grant, $270,870

Grants (continued)

2002–2005 • Principal Investigator, Pulse propagation and capture in Bragg grating optical fibers, NSF DMS–0204881, $73,001

Patents Awarded

10/5/2004 • R. H. Goodman, M. I. Weinstein and R. E. Slusher, Trapping light pulses at controlled perturbations in periodic optical structures, Patent No. US 6801685

Teaching

At NJIT

Undergraduate • Calculus I, Honors Calculus 2, Calculus 3A, Differential Equations, Intermediate Differential Equations (Dynamical Systems), Linear Algebra, Honors Linear Algebra, Applied Numerical Methods, Advanced Applied Numerical Methods, Mathematical Methods for Scientists and Engineers, Mathematical Analysis I, Honors Methods of Applied Mathematics 1 & 2 (Capstone course), Mathematical Modeling, Complex Analysis, Partial Differential Equations

Masters • Numerical Methods for Computation

Ph.D. • Asymptotic Methods I, Advanced Ordinary Differential Equations, Wave Propagation, Special Topics: Dynamical Systems

At NYU

Undergraduate • Precalculus Mathematics

Ph.D. Dissertation Advisor

2017– • Jimmie Adriazola

2016–2020 • Brandon Behring
Dissertation: *Dances and Escape of the Vortex Quartet*

2013–2016 • Casayndra Basarab
Dissertation: *Hamiltonian Bifurcations in Schrödinger Trimers*

2008–2011 • Jacek Wróbel
Dissertation *High-order Adaptive Method for Computing Invariant Manifolds of Maps*

Other Student Supervision

2009–2010 • Casayndra Basarab and Priyanka Shah, CSUMS Undergraduate Research Project

2007–2008 • Matthew Peragine and Fatima Elgammal, CSUMS Undergraduate Research Project

2010 • Kyle Mahady, Graduate Summer Research Project

2007 • Xiaoni Fang, Graduate Summer Research Project

2006 • Maciej Malej, Undergraduate Summer Research Project

2004–2017 • Member of dissertation committees for D. Cargill, M. Chabane, Y. Chen, Grace Conte (UNC–Chapel Hill), I. Jancigova, Y. Joshi, Y. Mileyko, A. Rahman, B. Ren

Service

University

2019–2022 • Member, Faculty Senate

2015–2018 • Member Honors College Bauder Scholarship Committee

2014–2017 • Member, University Senate Committee on Campus Life

2002–2004 • Advisor to undecided CSLA freshmen

2003–2005 • Member, NJIT committee on Health and Safety

Service (continued)

Department

2008– • Applied Math Undergraduate Advisor
2002–2003, 2011–2018 • Applied Mathematics Minor Advisor
2003–2010 • Undergraduate Math Club and Pi Mu Epsilon Honor Society Advisor
2007–2010 • Organizer, Wave Propagation Seminar

Peer reviewing activity

- **Panelist**, NSF Division of Mathematical Sciences (3 panels)
- **Grant Reviewer**, individual grants, NSF-DMS, Israel Science Foundation, MITACS (Canada)
- **Referee**, Anal. Appl., Appl. Math. Let., Chaos, Comm. Nonlin. Sci. Numer. Sim., Europhys. Lett., Euro. Phys. J. Plus, IMA J. Appl. Math., Int. J. Theor. Phys., J. Comput. Appl. Math., J. Comput. Phys., J. Eng. Math., J. High Energy Phys., J. Lightwave Technol., J. Low Temp. Phys., J. Nonlinear Sci., J. Opt. Soc. Am. B, J. Phys. A, Mathematics, Math. Comput. Simulat., Nonlinearity, Numer. Meth. PDE, Opt. Express, Opt. Lett., Phys. D, Phys. Rev. A, Phys. Rev. E, Phys. Rev. Fluids, Phys. Rev. Lett., P. Am. Math. Soc., P. Roy. Soc. A–Math. Phys., SIAM J. Appl. Dyn. Sys., SIAM J. Appl. Math., SIAM J. Math. Anal., SIAM Texbook Publishing Studies Appl. Math., Wave Motion

Professional Societies

• AMS
2017–2018 • SIAM Nonlinear Waves SIAG Martin Kruskal Lecturer Selection Committee
• SIAM, Society for Industrial and Applied Mathematics (member)
• SIAM, SIAG for Dynamical Systems Activity Group (member)
• SIAM, SIAG for Nonlinear Waves and Coherent Structures (member)
2009–2010 • SIAM, SIAG Nonlinear Waves and Coherent Structures (Secretary)

References

- **Prof. M. Gregory Forest**
  Grant Dahlstrom Distinguished Professor
  Department of Mathematics
  CB 3250 Phillips Hall
  University of North Carolina at Chapel Hill
  Chapel Hill, NC 27599
  (919) 962-9606
  forest@amath.unc.edu

- **Prof. Philip J. Holmes**
  Program in Applied and Computational Mathematics and
  Department of Mechanical and Aerospace Engineering
  Princeton University
  Princeton, NJ 08544-1000
  (609) 258-2958/5128
  pholmes@math.princeton.edu

References (continued)

- **Prof. David W. McLaughlin**
  Silver Professor of Mathematics and Neural Science
  Courant Institute of Mathematical Sciences
  New York University
  1113 Warren Weaver Hall
  251 Mercer St.
  New York, New York (US) 10012
  (212) 998-3077
  david.mclaughlin@nyu.edu

- **Prof. Michael I. Weinstein**
  Department of Applied Physics and Applied Mathematics
  Columbia University
  200 S.W. Mudd - MC4701
  New York, NY 10027
  (212) 854-3624
  miw2103@columbia.edu

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