

Krešimir Josić

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Education

PENNSYLVANIA STATE UNIVERSITY, Ph.D., Mathematics August 1999
(Dissertation: “Synchronization of Chaotic Systems”, C.E. Wayne, advisor)
UNIVERSITY OF TEXAS AT AUSTIN, B.Sc., Mathematics and B.Sc., Physics May 1994
(Summa cum laude and departmental honors)

Research Interests

Synchronization and coherent behavior in networks of complex systems with applications to neuroscience, genomics, and evolutionary biology, justification and extensions of formal perturbation methods.

Professional Experience

Associate Professor Fall 2007 – present
Assistant Professor Fall 2002 – Spring 2007
Department of Mathematics, University of Houston
Visiting Assistant Professor in Dynamical Systems Fall 1999 – Summer 2002
Department of Mathematics and Center for BioDynamics,
Boston University
Visitor Spring 1998 – Summer 1999
Department of Mathematics, Boston University
Graduate Assistant Spring 1994 – Fall 1998
Department of Mathematics, Pennsylvania State University

Adjunct Appointments

University of Texas at Houston, School of Public Health and Graduate School of Biological Sciences Fall 2007 – present

Book

K. Josić, J. Rubin, M. Matías and R. Romo, eds. *Coherent Behavior in Neuronal Networks*. Springer Verlag (2009).

Publications

*Publications in which authors appear in alphabetical order are marked with a *.*

1. Y. Sun, B. Danila, K. Josić and K. E. Bassler. “Improved community structure detection using a modified fine tuning strategy.” *Europhysics Letters* **86**, 28004 (2009).
2. K. Josić, E. Shea-Brown, B. Doiron, and J. de la Rocha. “Stimulus-dependent correlations and population codes.” *Neural Computation* **21**:10, 2774–2804 (2009).
3. D. Nevozhay, R. Adams, K. Murphy, K. Josić and G. Balazsi, “Negative autoregulation linearizes the dose response and suppresses the heterogeneity of gene expression.” *PNAS* **106**, 5123-5128 (2009).

4. F. Marpeau, A. Barua and K. Josić. “A finite volume method for stochastic integrate-and-fire models.” *Journal of Computational Neuroscience* **26** 445-57 (2009).
5. (*) K. Josić and R. Rosenbaum. “Instability in non-autonomous linear ODEs.” *SIAM Review* **50** 570–584 (2008).
6. K. Kelleher, V. Hajdik, K. Josić and C. Colbert. “Learning by structural remodeling in a class of single cell models.” *Journal of Computational Neuroscience* **25**:2, 282–295(2008).
7. Y. Timofeeva, S.J. Cox, S. Coombes and K. Josić. “Democratization in a passive dendritic tree: an analytical investigation.” *Journal of Computational Neuroscience* **25**:2, 228–244 (2008).
8. E. Shea-Brown, K. Josić, B. Doiron, and J. de la Rocha. “Universal properties of correlation transfer in integrate-and-fire neurons.” *Physical Review Letters* **100**, 108102 (2008).
9. (*) Ž. Bajzer, T. Carr, K. Josić, S.J. Russell, and D. Dingli. “Modeling of cancer virotherapy with recombinant measles viruses.” *Journal of Theoretical Biology* **252**:1, 109–122 (2008).
10. (*) R.E.L. DeVille, A. Harkin, M. Holzer, K. Josić, and T. Kaper. “Analysis of a Renormalization Group Method for Solving Perturbed Ordinary Differential Equations.” *Physica D* **237**: 8, 1029–1052 (2008).
11. E. Elhaik, D. Graur, and K. Josić. “Is there a nucleotide composition constraint on genome sequences?” *Computational Biology and Chemistry*, **32**, 147 (2008).
12. J. de la Rocha, B. Doiron, E. Shea-Brown, K. Josić, and A. Reyes. “Correlation between neural spike trains increases with firing rate,” *Nature* **448**, 802–806 (2007).
13. (*) N. Barlas, K. Josić, S. Lapin and I. Timofeyev. “Non-uniform decay of predictability and return of skill in stochastic oscillatory models.” *Physica D* **232**(2), 116–127(2007).
14. S. Coombes, Y. Timofeeva, C.-M. Svensson, G.J. Lord, K. Josić, S.J. Cox and C.M. Colbert. “Branching Dendrites with Resonant Membrane: A ”sum-over-trips” approach.” *Biological Cybernetics* **93**, 91–108 (2007).
15. J. Rubin and K. Josić. “Neuronal firing in the presence of stochastic trains of strong synaptic inputs,” *Neural Computation* **19**, 1251–1294 (2007).
16. (*) S. Coombes, B. Doiron, K. Josić, and E. Shea-Brown. “Toward blueprints for network architecture, biophysical dynamics, and signal transduction,” *Proceedings of the Royal Society A* **364**, 3301–3318 (2006).
17. K. Josić and A. Török. “Network structure and spatiotemporally symmetric dynamics,” *Physica D* **224**(1–2), 52–68 (2006).
18. K. Parwani and K. Josić, “The effect of architecture on the structure of rotation sets in coupled circle maps,” *Chaos*. **16**(1), 015115 (2006).
19. D. Dingli, M.D. Cascino, K. Josić, S.J. Russell, and Ž. Bajzer, “Mathematical modeling of cancer radiovirotherapy,” *Mathematical Biosciences* **199**(1), 55–78 (2006). (Epublised Dec 22, 2005).
20. (*) M. Golubitsky, K. Josić, and E. Shea-Brown, “Rotation, oscillation and spike numbers in phase oscillator networks,” *Journal of Nonlinear Science* **16**(4) 201-231 (2006).

21. K. Josić and J. Rubin. “Deriving information about architecture from activity patterns in coupled cell systems” *SIAM Journal on Applied Dynamical Systems* **4**(1), 53-77 (2005).
22. K. Josić and S. Peleš. “Synchronization in Networks of General, Weakly non-linear oscillators” *Journal of Physics A: Mathematical and General* **37**(49), 11801-11818 (2004).
23. M.S. Baptista, S. Boccaletti, K. Josić, and I. Leyva. “Irrational Phase Synchronization” *Physical Review E* **69**, 056228 (2004).
24. K. Josić and E. Sander “The Structure of Synchronization Sets for Noninvertible Systems” *Chaos* **14**(2), 249-262 (2004).
25. (*) R. L. Devaney, K. Josić, M. Moreno Rocha, P. Seal, Y. Shapiro, and A. T. Frumosu. “Playing catchup with iterated exponentials”, *American Mathematical Monthly* **111**(8), 704-709 (2004).
26. (*) R.L. Devaney, K. Josić, and Y. Shapiro “Singular perturbations of quadratic maps”, *International Journal of Bifurcations and Chaos* **14:1**, 161-171 (2004).
27. (*) E. Barreto, K. Josić, C. Morales, E. Sander, and P. So “The geometry of chaos synchronization”, *Chaos*, **13**, 151–164 (2003).
28. K. Josić and M. Beck. “A geometric theory of chaotic phase synchronization”, *Chaos* **13** 247–258 (2003).
29. P. So, E. Barreto, K. Josić, E. Sander, and S. J. Schiff “Limits on the experimental detection of nonlinear synchronization”, *Physical Review E*, **65** 046225 (2002).
30. K. Josić and D.J. Mar, “Phase synchronization of chaotic systems with small phase diffusion”, *Physical Review E*, **64**, 056234-1–056234-10, (2001).
31. (*) R. Bhattacharjee, R. L. Devaney, R. E. L. Deville, K. Josić, and M. Moreno-Rocha “Accessible Points in the Julia Set of Stable Exponentials”, *Discrete and Continuous Dynamical Systems B*, **1**(3), 299–318 (2001).
32. K. Josić and R.W. Hall, “The Mathematics of Musical Instruments”, *American Mathematical Monthly*, **108**(4), 347–357 (2001).
33. K. Josić “Synchronization of Chaotic Systems and Invariant Manifolds”, *Nonlinearity*, **13**(4), 1321–1336 (2000).
34. K. Josić and C.E. Wayne, “Dynamics of a Ring of Diffusively Coupled Lorenz Oscillators,” *Journal of Statistical Physics*, **98**(1), 1 – 30 (2000).
35. (*) K. Josić and R.W. Hall, “Planetary Motion and the Duality of Force Laws” *SIAM Review*, **42**(1), 114 – 125 (2000).
36. K. Josić “Invariant manifolds and synchronization of coupled dynamical systems”. *Physical Review Letters*, **80**(14) 3053 – 3056 (1998).
37. K. Josić “Local Bifurcations in the Symmetric Model of Selection with Fertility Differences”, *Journal of Theoretical Biology*, **189**, 291–295 (1997).

Book Chapters

ZZRQ Award for Outstanding Achievement by a Doctoral Candidate (Pennsylvania State University)	1999
Curry Fellow at Pennsylvania State University	1994–1996

Grants Awarded

If applicable, the percentage of credit for the grant is given.

NSF: Correlations in neural dynamics and coding (2008-11) <i>with B. Doiron (Pitt) and E. Shea–Brown (U.W., Seattle)</i>	\$151,134
ARP/ATP: Dynamics and Function of Feed Forward Networks (2008-10) <i>PI: Josic (50%), Co-PI: M. Golubitsky (50%)</i>	\$148,000
NSF: Applications of Coupled Cell Systems (2006-09) <i>PI: Golubitsky (50%), Co-PI: Josic (50%)</i>	\$420,000
REU Supplement to above NSF grant (2008–09) <i>M. Golubitsky, K. Josic and M. Tomforde</i>	\$44,000
ARP–ATP: Theory and Applications of Coupled Systems (2006-08) <i>PI: Golubitsky (50%), Co-PI: Josic (50%)</i>	\$79,000
UK-Texas Biosciences Initiative (2005-06) <i>Award made to S. Coombes research group in England for visits to Houston.</i>	£9,000
NSF: CMG Collaborative Research: Predictability and Dynamics of Models of Quasigeostrophic Turbulence and Their Low-Dimensional Truncations (2004-07) <i>PI: Glowinski (34%), with Co-PIs: Josic (33%) and Timofeyev (33%).</i>	\$422,964
NSF: REU Program in Mathematical Biology (2003-05) <i>PI: S. Canic.</i>	\$100,000
NSF: Focused Research Group: Synchrony and Structure in Coupled Cell Systems (2003-06). <i>2005–2006 PI: Josic (25%), Co-PIs: Golubitsky (25%), Field (25%), and Torok (25%). 2003–2005 PI: Golubitsky (25%), Co-PIs: Field (25%), Josic (25%) and Torok (25%).</i>	\$960,758

Internal grants and workshop support

UH Quality Enhancement Program: Mathematical Biology (2009) <i>PI: Josic, Co-PIs: R. Azevedo, K. Bassler, B. Bodmann, T. Cooper, C. Peters</i>	\$19,954
NSF: International Workshop on Coherent behavior in neuronal networks (2007) <i>PI: Josic (50%), Co-PI: J. Rubin (U. Pittsburgh) (50%)</i> Additional funding by ONR, Spanish and EU governments (~ \$18,000)	\$14,410
UH GEAR Grant: The Structure and Dynamics of Networks (2005-06) <i>PI: Josic.</i>	\$20,562

Center grants

The following are larger grants awarded to the GCC for Theoretical and Computational Neuroscience during my tenure on the steering committee. I appear as co-PI or senior personnel, and am also part of the training personnel.

NIH–NIBIB: Training in Theoretical and Computational Neuroscience (2007-12)	\$727,000
NSF: REU Site for Theoretical and Computational Neuroscience (2008–11)	\$214,019

Invited Lectures and Presentations at Conferences

SIAM Annual Meeting, Denver, CO	2009
FACM – 2009, NJIT, Newark, NJ	2009
SIAM Dynamical Systems, Snowbird, CO	2009
SIAM Life Sciences, Montreal, Canada	2008
SIAM Annual Meeting, San Diego, CA	2008
AMS regional meeting, Baton Rouge, LA	2008
SIAM Dynamical Systems, Snowbird, CO	2007
Dynamics Days, Boston, MA	2007
Theoretical Neuroscience Network, Bristol, UK	2006
Neuromath, San Julia de Lorria, Andorra.	2006
SIAM Life Sciences, Raleigh, NC.	2006
International Workshop on the Dynamics on Complex Networks, Dresden, Germany	2006
Theory and Application of Coupled Cell Networks, Cambridge, UK	2005
SIAM Conference on Applications of Dynamical Systems, Snowbird, CO	2005
Workshop on Mathematical Neuroscience, Edinburgh, Scotland	2005
Houston Society for Engineering in Biology and Medicine Annual Meeting, Houston, TX	2005
Coupled 60 Workshop, Houston, TX	2005
5th International Conference on Dynamical Systems and Diff. Equations, Pomona, CA	2004
6th Joint Meeting of the AMS and SMM, Houston, TX	2004
2nd Texas Dynamical Systems Workshop, Houston, TX	2004
5th International Congress on Industrial and Applied Mathematics, Sydney, Australia	2003
SIAM Conference on Applications of Dynamical Systems, Snowbird, CO	2003
AMS Sectional Meeting 982, Orlando, FL	2002
SIAM Conference on Life Sciences (minisymposium organizer and speaker) Boston, MA.	2002
Dynamics Days 2002, Baltimore, MD (poster presentation)	2002
4th International Conference on Dynamical Systems and Diff. Equations, Willmington, NC	2002
Workshop on the Control and Synchronization of Dynamical Systems Max Planck Institute, Dresden, Germany.	2001
SIAM Conference on Applications of Dynamical Systems, Snowbird, CO	2001
Gordon Conference on Nonlinear Science (discussion leader) Mount Holyoke College, South Hadley, MA	2001
Semi-annual Workshop on Dynamical Systems and Related Topics University of Maryland, College Park, MD	2001
Pacific Rim Dynamical Systems Conference (minisymposium organizer and speaker) Maui, Hawaii	2000
Symposium on the Synchronization of Chaotic Systems, The Abdus Salam ICTP, Trieste, Italy	2000
Nonlinear Science 2000 →, Courant Institute, New York, NY (poster presentation)	2000
Complex Synchrony in Neuroscience Krasnow Institute for Advanced Study, GMU, Fairfax, VA	2000
953rd AMS meeting, Session on Applications of Invariant manifolds University of Notre Dame, Notre Dame, IN	2000
SIAM Conference on Applications of Dynamical Systems, Snowbird, CO	1999
Midwest Dynamical Systems Conference Northwestern University, Evanston, IL	1998
Semi-annual Workshop on Dynamical Systems and Related Topics	1997

Pennsylvania State University, State College, PA	
Annual Meeting of the Society for Mathematical Biology	1997
University of North Carolina, Chapel Hill, NC	

Invited Lectures at Universities and Colleges

Columbia University, Center for Theoretical Neuroscience	2009
Trinity University, Majors' Seminar	2009
Brown University, Dynamical Systems Seminar	2009
University of Oklahoma, Colloquium and Undergraduate Seminar	2008
Baylor College of Medicine, Neuroscience Seminar	2006
University of Texas, School of Public Health, Biostats Colloquium	2005
Southern Methodist University, Department of Mathematics Colloquium	2005
Trinity University, Department of Mathematics Colloquium	2005
New York University, Computational Neuroscience Seminar	2004
University of Texas at Arlington, Applied Mathematics Seminar	2004
Georgia Institute of Technology, Center for Nonlinear Science Colloquium	2004
University of Texas at San Antonio, Mathematics Colloquium	2003
Rice University, Mathematics Colloquium	2003
College of the Holy Cross, Colloquium	2003
Worcester Polytechnic Institute, Colloquium	2003
Georgia Institute of Technology, Nonlinear Dynamics Seminar	2003
University of Texas at Austin, Dynamical Systems Seminar	2002
Boston University, Dynamical Systems Seminar	2002
Georgetown University, Department of Mathematics	2002
University of Houston, Department of Mathematics	2002
University of Texas at Austin, Mathematical Physics Seminar	2002
Tufts University, Department of Mathematics Colloquium	2001
Boston University Academy, Masterclass (talented high school students)	2001
Rensselaer Polytechnic Institute, Department of Mathematics Colloquium	2001
SUNY, Stony Brook, Dynamical Systems Seminar	2000
Universitat Autònoma de Barcelona, Department of Mathematics Colloquium	2000
University of Houston, Nonlinear Dynamics Seminar	2000
New Jersey Institute of Technology, Department of Applied Mathematics Colloquium	2000
Institute for Physical Sciences Seminar, University of Maryland	2000
George Mason University, Department of Physics Colloquium	2000
Dartmouth College, Department of Mathematics Colloquium	1999
Trinity College, Department of Mathematics Colloquium	1999
George Mason University, Department of Mathematics Colloquium	1999
Boston University, Center for BioDynamics Seminar	1998
Boston University, Dynamical Systems Seminar	1998, 2000
Pennsylvania State University, Dynamical Systems Seminar	1996
Pennsylvania State University, Slow Pitch Graduate Student Seminar	1996
University of Texas at Austin, Dynamical Systems Seminar	1994

Students Supervised

Robert Rosenbaum, Ph.D. candidate	current
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Ajit Kumar, Ph.D. candidate	current
Keith Kelleher, Ph.D. candidate (Biology, with P. Saggau and M. Rea)	current
James Trousdale, Ph.D. candidate	current
Aditya Barua, M.Sc. Simulating neuronal networks using the Fokker-Planck equation	graduated summer 2009.
Huy Loi, M.Sc. Stochastic processes in biology	graduated spring 2005.
Aerie Brown, M.Sc. Information theoretic methods in DNA sequence analysis.	graduated spring 2005.
Christy Jew, M.Sc. Plasticity in neuronal networks	graduated spring 2005.
Matthew Stone, M.Sc. Reliable response of a model subthalamopallidal neuron.	graduated spring 2004.
Yakov Shapiro, undergraduate student Singularly perturbed quadratic maps, this work initiated a series of papers available at http://math.bu.edu/people/bob/papers.html	Summer 2001- Summer 2002
Melanie Palma, M.A. Phase response curves for nonperiodic oscillators	Fall 2001

Outreach Activities

Contributor to “Engines of Our Ingenuity” http://www.uh.edu/engines/	2009–
Seminar leader, Houston Teachers Institute (HTI) http://hti.math.uh.edu/	Spring 2008

Course and program development

Lead the development of the program leading to a degree in Mathematical Biology offered jointly by the Departments of Mathematics and Biology and Biochemistry.

Participated in the development of three new undergraduate courses: Biostatistics, Mathematics of Evolution, and Mathematical Biology that are offered as part of the degree.

Developed graduate courses in Mathematical Neuroscience, Information Theory and Stochastic Processes.

Courses Taught

*Graduate courses are marked with a **

Mathematics of Evolutionary Theory (10 students)	Spring 2009
Probability and Statistics (*) (26 students)	Fall 2008 – Spring 2009
Engineering Mathematics (online course)	Spring 2008
Introduction to Information Theory (*) (8 students)	Fall 2007
Complex Analysis (12 students)	Fall 2007
Nonlinear Dynamics (18 students)	Spring 2007
Introduction to Mathematical Neuroscience (*) (8 students)	Spring 2007
Ordinary Differential Equations (58 students)	Fall 2006
Stochastic Processes (15 students)	Fall 2006
Dynamical Systems II (*) (7 students)	Spring 2006
Concepts in Algebra (82 students)	Fall 2006

Dynamical Systems I (*) (7 students)	Fall 2006
Stochastic Processes (14 students)	Spring 2005
Calculus III (115 students)	Fall 2004
Mathematical and Computational Neuroscience (*) (17/11 students) a graduate, two semester course	Fall 2003/Spring 2004
Nonlinear Dynamics 2 (4 students)	Spring 2003
Introduction to Statistics and Probability (80 students)	Fall 2002
Graduate Seminar on Invariant Manifolds (*) (8 students)	Spring 2002
Calculus for Life Sciences I (60 students)	Spring 2002
Differential Equations (*) (6 students)	Fall 2001
Methods of Applied Mathematics (undergraduate/graduate, 20 students)	Fall 2001
Differential Equations (126 students)	Spring 2001
Calculus II (60 students)	Spring 2001
Differential Equations (*) (3 students)	Fall 2000
Calculus for Life Sciences I (60 students)	Fall 2000
Calculus for Life Sciences II (40 students)	Spring 2000
Discrete Mathematics (14 students)	Spring 2000
Calculus for Life Sciences (190 students)	Fall 1999
Calculus I (42 students)	Spring 1998
Calculus III (39 students)	Fall 1997
Differential Equations and Boundary Value Problems (graduate, 8 students)	Summer 1997
Linear Algebra (60 students)	Spring 1997
Differential Equations (40 students)	Fall 1996
Calculus I (30 students)	Summer 1995

Reviewer for

Automatica, Chaos, Discrete and Continuous Dynamical Systems, IEEE Journals,
 J. of Computational Neuroscience, J. of Neuroscience, J. of Physics A, NSF
 Nonlinearity, Physica D, Physics Letters A, Physical Review E, Physical Review Letters
 Proceedings of the Royal Society A, Journal of Mathematical Analysis and Applications
 SIAM Journal on Dynamical Systems, SIAM Journal on Mathematical Analysis.

Related Experience and Service

NSF Panel	2008
Organizer of the UH Networks Seminar http://wwworm.bio.uh.edu/networks	Fall '07 – present
Organizer of conference “Coherent Behavior in Neuronal Networks.”	October 2007
Organizer of minisymposia on synchrony in neuroscience SIAM Conference on Applications of Dynamical Systems, Snowbird, CO	May 2003, 2005
Local Organizer of the Coupled 60 Workshop	February 2005
Local Organizer of the Joint AMS/SMM Meeting	May 2004.
Houston Mathematics Department Colloquium Organizer	Fall 2003/Spring 2004
Organizer of the Nonlinear Dynamics / Neurodynamics Seminar http://www.math.uh.edu/~josic/seminars/	Fall 2002 - 2003
Organizer of the 1st Texas Dynamics Workshop, UT Austin http://www.ma.utexas.edu/~martense/dynamics/	Spring 2003
Organizer of symposium entitled “Invariant Manifolds and Applications” at	Spring 2002

the 4th International Conference on DE in Wilmington, NC.

Organizer of Minisymposium on bursting at SIAM Life Sciences Conference Spring 2002

Organizer of the Boston University Dynamical Systems Seminar Fall 1999 – Spring 2002
<http://math.bu.edu/dynamics/seminar.html>

Organizer of minisymposium on phase locking in chaotic systems Summer 2000
 SIAM Pacific Rim Conference, Hawaii

Co-organizer of seminar on phase locking analysis and applications Summer 2001 – Spring 2002

Organizer of seminar on noise in dynamical models of neurons Spring 2001

Organizer of a seminar on invariant manifolds and applications Spring 1999

Member of Center for BioDynamics Spring 1998 – Spring 2002

Experience in Working with Undergraduates, and High School Students

Supervised research of Paloma Valenzuela 2009 -

Supervised research of Manuel Lopez 2008 -

Supervising research of Melody Lin, Sarah Kazzaz 2007 - 2008

Supervising summer research of N. Laurie and R. Rosenbaum 2006

Co-supervised research of 5 undergraduates with C. Colbert (Biology) 2003 - 2005

Supervised research of two undergraduate students Summer 2001 - Summer 2002

Guest lecturer in PROMYS program (talented high school students) Summer 2000

Guest lecturer and co-organizer of BU Academy Seminars (high school) Spring 2000, 2002

Putnam team trainer at Boston University Fall 1999 - Spring 2001

Collaborator in the Honors Calculus Project Fall 1996 – Fall 1997

Sample of work is available at <http://www.math.psu.edu/hall/newton>