Samuel A. Isaacson - Short CV

CONTACT INFORMATION

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CURRENT RESEARCH INTERESTS

My research interests are in the areas of numerical analysis, mathematical biology, and mathematical physics, with an emphasis on the development and the numerical analysis of methods for studying problems in molecular cell biology. I am especially interested in the numerical analysis of schemes for solving systems of partial differential, ordinary differential, and integral equations. Recently, my research has focused on the development, analysis, numerical approximation, and applications of stochastic as well as deterministic reaction-diffusion methods appropriate for modeling biochemical systems at the scale of a single biological cell.

APPOINTMENTS

Department of Mathematics and Statistics, Boston University
Boston, MA USA

Associate Professor of Mathematics (May 2014 - Present)
Assistant Professor of Mathematics (Fall 2008 - May 2014)

- Member, Graduate Program in Bioinformatics (December 2011 - Present)
- Faculty Affiliate, Hariri Institute for Computing and Computational Science & Engineering (September 2011 - Present)
- Member, Center for Biodynamics (Spring 2009 - Summer 2011)

Biomathematics Research Group, Department of Mathematics, University of Utah
Salt Lake City, Utah USA

Postdoctoral Fellow (Fall 2005 - Summer 2008)

EDUCATION

Courant Institute of Mathematical Sciences, New York University
New York, New York USA

Ph.D. in Mathematics (September 2005)
- Dissertation Topic: "A Stochastic Reaction–Diffusion Method for Studying the Control of Gene Expression in Eukaryotic Cells"
- Adviser: Charles S. Peskin

MS Mathematics, 2001

Brown University
Providence, Rhode Island USA

BS Applied Mathematics–Computer Science, May 2000
Graduated *Magna Cum Laude* with 4.0 GPA

HONORS AND AWARDS

2016	Simons Foundation Fellowship of the Isaac Newton Institute for Mathematical Sciences
2013–2018	NSF CAREER Award Recipient, DMS, Computational Mathematics
2005	Moses A Greenfield Research Award for Outstanding Interdisciplinary Studies, Courant Institute of Mathematical Sciences
2000–2005	MacCracken Fellow, Courant Institute of Mathematical Sciences
2000	Rohn Truell Premium Award in Applied Mathematics, Division of Applied Mathematics, Brown University
2000	*Magna Cum Laude*, Brown University
2000	College Honors, Brown University
2000	Sigma Xi
1996–2000	Theodore Jaffe' 32 I/II/III National Scholarships, Brown University

FUNDED GRANTS

NSF - DMS, Mathematical Biology, 1548520, PI for: *U.S. Participation in Newton Institute Program on Stochastic Dynamical Systems in Biology: Numerical Methods and Applications*, $23,530.00 (2016).

NSF - DMS, Computational Mathematics, 1255408, PI for Project: *CAREER: Numerical Methods for Stochastic Reaction-Diffusion Equations*, $434,043 (2013–2018).

NSF - DMS, Mathematical Biology, 0920886, PI for Project: *Multiscale Modeling of Subcellular Structure and its Effects on Gene Expression and Regulation*, $272,515 (2009–2013).

NIH - NIGMS, P50GM071558, Systems Biology Center New York, Center Member and Consultant for Subproject: *Explicit 3D Models of the Spatiotemporal Effects of the Regulatory Loops in cAMP Dependent Heart Failure*. Mount Sinai School of Medicine, NY, NY. Approximate Center Funding: $13,000,000, Approximate Project Funding: $1,000,000 (2007–2012).

PUBLICATIONS

S. A. Isaacson and Y. Zhang, *An Unstructured Mesh Convergent Reaction-Diffusion Master Equation for Reversible Reactions*, In Review, arXiv:1711.04220 (2017).

J. Goyette, C. S. Salas, N. Coker-Gordon, M. Bridge, S. A. Isaacson, J. Allard, and O. Dushek, *Biophysical assay for tethered signaling reactions reveals tether-controlled activity for the phosphatase SHP-1*, Science Advances, Vol 3, No. 3, e1601692 (14 pp) (2017).

S. A. Isaacson, A. J. Mauro, and J. Newby, *Uniform Asymptotic Approximation of Diffusion to a Small Target: Generalized Reaction Models*, Phys. Rev. E, Vol. 94, No. 4, 042414 (17 pp) (2016).

S. J. Chapman, R. Erban, and S. A. Isaacson, *Reactive Boundary Conditions as Limits of Interaction Potentials for Brownian and Langevin Dynamics*, SIAM Journal on Applied Mathematics, Vol. 76, No. 1, pp 368-390 (2016).

M. Do, S. A. Isaacson, G. McDermott, M. A. Le Gros, and C. A. Larabell, *Imaging and Characterizing Cells using Tomography*, Arch. Biochem. and Biophys., Vol. 581, pp 111-121 (2015).

I. C. Agbanusi and S. A. Isaacson, *A Comparison of Bimolecular Reaction Models for Stochastic Reaction-Diffusion Systems*, Bulletin of Mathematical Biology, Vol. 76. No. 4, pp 922-946 (2014).

A. J. Mauro, J. K. Sigurdsson, J. Shrake, P. J. Atzberger, and S. A. Isaacson, *A First-Passage Kinetic Monte Carlo Method for Reaction-Drift-Diffusion Processes*, J. Computational Physics, Vol. 259, pp 536-567 (2014).

S. A. Isaacson, C. A. Larabell, M. A. Le Gros, D. M. McQueen, and C. S. Peskin, *The Influence of Spatial Variation in Chromatin Density Determined by X-ray Tomograms on the Time to Find DNA Binding Sites*, Bulletin of Mathematical Biology, Vol. 75, No. 11, pp 2093-2117 (2013).

S. A. Isaacson, *A Convergent Reaction-Diffusion Master Equation*, J. Chem. Phys., Vol. 139, No. 5, 054101 (12 pp) (2013).

S. A. Isaacson and J. Newby, *Uniform Asymptotic Approximation of Diffusion to a Small Target*, Phys. Rev. E, Vol. 88, No. 1, 012820 (13 pp) (2013).

S. A. Isaacson and R. M. Kirby, *Numerical Solution of Linear Volterra Integral Equations of the Second Kind with Sharp Gradients*, J. Comput. Appl. Math., Vol. 235, No. 14, pp 4283-4301 (2011).

S. A. Isaacson, D. M. McQueen, and C. S. Peskin, *The Influence of Volume Exclusion by Chromatin on the Time Required to Find Specific DNA Binding Sites by Diffusion*, Proceedings of the National Academy of Sciences, Vol. 108, No. 9, pp 3815-3820 (2011).

S. A. Isaacson and D. Isaacson, *Reaction-Diffusion Master Equation, Diffusion-Limited Reactions, and Singular Potentials*, Phys. Rev. E, Vol. 80, No. 6, 066106 (9 pp) (2009).

S. A. Isaacson, *The Reaction-Diffusion Master Equation as an Asymptotic Approximation of Diffusion to a Small Target*, SIAM J. Appl. Math., Vol. 70, No. 1, pp 77-111 (2009).

P. J. Atzberger, S. A. Isaacson, and C. S. Peskin, *A Microfluidic Pumping Mechanism Driven by Non-Equilibrium Osmotic Effects*, Physica D, Vol. 238, No. 14, pp 1168-1179 (2009).

S. A. Isaacson, *Relationship Between the Reaction-Diffusion Master Equation and Particle Tracking Models*, J. Phys. A: Math. Theor., Vol. 41, No. 6, 065003 (15 pp) (2008).

S. A. Isaacson and C. S. Peskin, *Incorporating Diffusion in Complex Geometries into Stochastic Chemical Kinetics Simulations*, SIAM J. Sci. Comput., Vol. 28, No. 1, pp 47-74 (2006).

S. A. Isaacson, *Stochastic Reaction-Diffusion Methods for Modeling Gene Expression and Spatially Distributed Chemical Kinetics*, Ph.D. dissertation, New York University, United States – New York (2005).