

Guang Song

Department of Computer Science
Iowa State University
107 Atanasoff Hall
Ames, Iowa 50011-1041

email: gsong@cs.iastate.edu
work tel: (515) 294-1696
work fax: (515) 294-0258
<http://www.cs.iastate.edu/~gsong>

Research Interests

Protein Structure and Dynamics, Protein Folding Pathways, Energy Landscape, and Kinetics, Ligand Migration Pathways, Ligand Binding, Structure-Function Studies of Biophysical Processes

Motion Planning, Robotics, Human-Computer Interaction, Virtual Reality, Molecular Docking
Quantum Computing

Education

Ph.D. in Computer Science, Texas A&M University, December 2003

Ph.D. Thesis: *A Motion Planning Approach to Protein Folding*

Thesis advisor: Prof. Nancy M. Amato

M.S. in Physics, Texas A&M University, May 1998 (GPA 4.00/4.00)

M.S. Thesis: *Antikaon Production and Medium Effects in Relativistic Heavy-Ion Collisions*

Thesis advisor: Prof. Che-Ming Ko

B.S. in Physics, Jilin University, China, July 1992 (Major GPA 94.5/100, Class rank 1/52)

Honors and Awards

IBM Research PhD Fellowship, 2002 – 2003.

Excellent Graduate Student Research Award, Computer Science Department, Texas A&M University, 2003.

Anton Philips Best Student Paper Award Finalist, IEEE International Conference on Robotics and Automation (ICRA), May 2001. Paper Title: “A Motion Planning Approach to Folding: From Paper Craft to Protein Folding” (6 finalists from 678 accepted papers)

Recipient of the Challenges in Quantum Computing Award, Computer Science Department, Texas A&M University, Fall 2001

Undergraduate Scholarship for Academic Excellence, Jilin University, 1989 – 1992 (Class rank 1/52)

Professional Experience

Assistant Professor, Department of Computer Science, Iowa State University, Fall 2006 – present

Faculty Member, Bioinformatics and Computational Biology (BCB) Graduate Program, Iowa State University, Fall 2006 – present

Faculty Member, Laurence H. Baker Center for Bioinformatics and Biological Statistics, Iowa State University, Fall 2006 – present

Postdoctoral Research Associate, Advisor: Prof. Robert L. Jernigan, Laurence H. Baker Center for Bioinformatics and Biological Statistics, Iowa State University, Fall 2003 – present

Instructor, Department of Computer Science, Texas A&M University, Spring 2002

Taught 5 week graduate class in bioinformatics. Covered an introduction to bioinformatics, protein structure basis, protein structure prediction methods, PRM-based approach to protein folding pathways, molecular dynamics, Monte Carlo simulation, statistical mechanical models, lattice models, folding kinetics.

Research Assistant, Department of Computer Science, Texas A&M University, 1998 – 2002

Applied motion planning techniques to study protein folding pathways and kinetics.
Applied randomized motion planners and PHANToM haptic device to molecular docking.
Worked on Randomized Probabilistic Roadmap (PRM) algorithms for motion planning.
Researched cooperative man-machine motion planning using PHANToM haptic device.
Developed motion planning techniques for nonholonomic systems, e.g., car-like robots.

Research Assistant, Department of Physics & Cyclotron Institute, Texas A&M University, Summer 1997

Using a large simulation program as an event generator, built subroutines to study antikaon production in relativistic nucleus-nucleus collisions.

Teaching Assistant, Department of Physics, Texas A&M University, 1995 – 1998

Courses: Undergraduate Mechanics, Electricity & Optics.
Weekly TA duties: taught recitation (2 hr), lab instruction (4 hr), graded homework and lab reports, held office hours and help desk hours.

Full-time Assistant Researcher, China Institute of Atomic Energy, Beijing, 1992 – 1995

Developed computer simulation programs to study physics in relativistic heavy ion collisions.

Professional Activities

Program Committee Member, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2005, 2006.

Robotics: Science and Systems (RSS), 2006, 2007.

Reviewer, for journals (*Bioinformatics*, *IEEE Transactions on Robotics*, *IEEE Transactions on Automation Science and Engineering*, *International Journal of Robotics Research*, *IEEE Transactions on Parallel and Distributed Systems*), and conferences (*Pacific Symposium of Biocomputing (PSB)*, *International Conference on Research in Computational Molecular Biology (RECOMB)*, *IEEE International Conference on Robotics and Automation (ICRA)*).

Publications in Refereed Journals and Conferences

Computational Biology:

- [1] Guang Song and Robert L. Jernigan, “vGNM: a Better Model for Understanding the Dynamics of Proteins in Crystals” *Journal of Molecular Biology*, 2007, to appear.
- [2] Lei Yang, Guang Song, and Robert L. Jernigan, “How Well Can We Understand Large-Scale Protein Motions Using Normal Modes of Elastic Network Models?” *Biophysical Journal*, 2007, to appear.

- [3] Guang Song and Robert L. Jernigan, “An Enhanced Elastic Network Model to Represent the Motions of Domain-Swapped Proteins,” *Proteins*, 63(1):197-209, 2006.
- [4] Shawna Thomas, Guang Song, and Nancy M. Amato, “Protein folding by motion planning,” *Physical Biology*, 2(4):S148-55, 2005.
- [5] Xinyu Tang, Bonnie Kirkpatrick, Shawna Thomas, Guang Song, and Nancy M. Amato, “Using Motion Planning to Study RNA Folding Kinetics,” *Journal of Computational Biology*, 12(6):862-81, 2005.
- [6] Xinyu Tang, Bonnie Kirkpatrick, Shawna Thomas, Guang Song, and Nancy M. Amato, “Using Motion Planning to Study RNA Folding Kinetics,” in *Proceedings of the 8th ACM International Conference on Computational Molecular Biology (RECOMB)*, pp. 252-261, March 2004, San Diego, California.
- [7] Guang Song and Nancy M. Amato, “A Motion Planning Approach to Folding: From Paper Craft to Protein Folding,” *IEEE Transactions on Robotics and Automation*, 20(1):60-71, 2004.
- [8] Nancy M. Amato, Ken A. Dill, and Guang Song, “Using Motion Planning to Map Protein Folding Landscapes and Analyze Folding Kinetics of Known Native Structures,” *Journal of Computational Biology*, 10(3-4):239-256, 2003. Featuring selected papers from *RECOMB* 2002.
- [9] Guang Song, Shawna L. Thomas, Ken A. Dill, J. Martin Scholtz and Nancy M. Amato, “A Path Planning-based Study of Protein Folding with a Case Study of Hairpin Formation in Protein G and L,” in *Proceedings of the 2003 Pacific Symposium on Biocomputing (PSB)*, pp. 240-251, January 2003, Hawaii, U.S.A.
- [10] Nancy M. Amato, Ken A. Dill, and Guang Song, “Using Motion Planning to Map Protein Folding Landscapes and Analyze Folding Kinetics of Known Native Structures,” in *Proceedings of the 6th ACM International Conference on Computational Molecular Biology (RECOMB)*, pp. 2-11, April 2002, Washington D.C., U.S.A.
- [11] Nancy M. Amato and Guang Song, “Using Motion Planning to Study Protein Folding Pathways,” *Journal of Computational Biology*, 9(2):149-168, 2002. Featuring selected papers from *RECOMB* 2001.
- [12] Guang Song and Nancy M. Amato, “A Motion Planning Approach to Folding: From Paper Craft to Protein Folding,” in *Proceedings of the 2001 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 948-953, May 2001, Seoul, Korea. **One of six finalists selected from 678 accepted papers for Best Student Paper Award.**
- [13] Guang Song and Nancy M. Amato, “Using Motion Planning to Study Protein Folding Pathways,” in *Proceedings the 5th ACM International Conference on Computational Molecular Biology (RECOMB)*, pp. 287-296, April 2001, Montreal, Canada.

Virtual Reality and Haptic Input:

- [14] O. Burchan Bayazit, Guang Song, and Nancy M. Amato, “Ligand Binding with OBPRM and User Input,” in *Proceedings of the 2001 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 954-959, May 2001, Seoul, Korea.

- [15] O. Burchan Bayazit, Guang Song, Nancy M. Amato, “Enhancing Randomized Motion Planners: Exploring with Haptic Hints,” *Autonomous Robots*, 10(2):163-174, 2001. Special issue on Personal Robotics.
- [16] O. Burchan Bayazit, Guang Song, Nancy M. Amato, “Enhancing Randomized Motion Planners: Exploring with Haptic Hints,” in *Proceedings of the 2000 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 529-536, April 2000, San Francisco, California.

Motion Planning Techniques and Applications:

- [17] Guang Song, Shawna L. Thomas, and Nancy M. Amato, “A General Framework for PRM Motion Planning,” in *Proceedings of the 2003 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 4445-50, September 2003, Taiwan.
- [18] Guang Song and Nancy M. Amato, “Randomized Motion Planning for Car-like Robots with C-PRM,” in *Proceedings of the 2001 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 37-42, November 2001, Hawaii, U.S.A.
- [19] Guang Song, Shawna Miller, Nancy M. Amato, “Customizing PRM Roadmaps at Query Time,” in *Proceedings of the 2001 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 1500-1505, May 2001, Seoul, Korea.

Quantum Computing:

- [20] Guang Song and Andreas Klappenecker, “Optimal Realizations of Simplified Toffoli Gates,” *Journal of Quantum Information and Computation*, 4(5):361-372, 2004.
- [21] Guang Song and Andreas Klappenecker, “Optimal Realizations of Controlled Unitary Gates,” *Journal of Quantum Information and Computation*, 3(2):139-155, 2003.

Physics:

- [22] Guang Song, Bao-An Li, Che-Ming Ko, “Antikaon Production and Medium Effects in Heavy-Ion Collisions at AGS,” *Nuclear Physics A*, 646(4):481-499, 1999.
- [23] Zhongqi Wang, Benhao Sa, Guang Song, Xiaoze Zhang, Zhongdao Lu, Yuming Zheng, “Rescattering Effect of Pion on K/PI Ratio in Relativistic Nucleus-Nucleus Collisions,” *Nuclear Physics A*, 566:495-498, 1994.
- [24] Zhongqi Wang, Benhao Sa, Xiaoze Zhang, Guang Song, Zhongdao Lu, Yuming Zheng, “Systematic Behavior of K/PI Ratio in Relativistic Nucleus-Nucleus Collisions,” *Physical Review C*, 48(6):2995-2999, 1993.
- [25] Zhongqi Wang, Benhao Sa, Xiaoze Zhang, Zhongdao Lu, Guang Song, Yuming Zheng, “Rapidity, Transverse Mass Distribution and Nuclear Stopping in 14.6GeV/c Si+Au Reactions,” *Chinese Physics Letters*, 10:468, 1993.

Other Publications (not refereed) and Posters

- [26] O. Burchan Bayazit, Guang Song, Nancy M. Amato, “Ligand Binding with OBPRM and Haptic User Input: Enhancing Automatic Motion Planning with Virtual Touch,” *Currents in Computational Molecular Biology*, N. El-Mabrouk, T. Lengauer and D. Sankoff (eds.), Les Publications CRM, Montreal, Canada, 2001, pp. 81-82. Book includes short papers from the 5th ACM International Conference on Computational Molecular Biology (*RECOMB*), April 2001, Montreal, Canada.
- [27] Nancy M. Amato and Guang Song, “A Motion Planning Approach to Protein Folding,” Poster, *the 8th International Conference on Intelligent System for Molecular Biology (ISMB)*, August 2000, La Jolla, California.
- [28] Nancy M. Amato, O. Burchan Bayazit, Guang Song, “Providing Haptic ‘Hints’ to Automatic Motion Planners,” in *Proceedings of the 4th PHANTOM User’s Group Workshop (PUG)*, October 1999.
- [29] Guang Song, “Parton Cascade Model,” in *Proceedings of Modeling Relativistic Heavy Ions Collisions Workshop*, China Center of Advanced Science and Technology, 1994, Beijing, China.