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Dept. of Electrical & Computer Engineering
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Research Interests

Self-assembling Computer Systems and Architecture, Resonance Energy Transfer Devices, Circuits and Systems, Self-assembling Device Fabrication, DNA Nanotechnology.

Education

University of North Carolina at Chapel Hill	Ph. D.	Computer Science	May 2003
University of North Carolina at Chapel Hill	M.S.	Computer Science	May 2000
Pennsylvania State University	B.S.	Computer Engineering	May 1998

Academic Positions

Associate Professor (tenured), Duke University (5/11– present)
Assistant Professor, Duke University (7/04 – 5/11)
Visiting Assistant Professor, Duke University (8/03 – 7/04)
Research Associate, University of North Carolina at Chapel Hill, (5/03 – 7/03)
Research Assistant, University of North Carolina at Chapel Hill, (8/98 – 5/03)

Honors and Awards

National Security Science and Engineering Faculty Fellowship, 2014.
Kavli Fellow, National Academy of Sciences, 2011.
Senior Member of the ACM, 2011.
Presidential Early Career Award for Scientists and Engineers (PECASE), 2009.
Member, DARPA Computer Science Study Group, 2009-12.
Senior Member of the IEEE, 2009.
Young Investigator Award, ARO, 2008.
Microsoft Research New Faculty Fellowship Finalist, 2006.
Membership in Eta Kappa Nu, Tau Beta Pi, and Golden Key National Honor Societies.

Book(s) and Chapters

1. C. Dwyer, A. Rallapalli, M. Mottaghi, S. Wang, "Chapter 2: DNA Self-assembled Nanostructures for Resonance Energy Transfer Circuits", *Nanophotonic Information*

Physics: Nanointelligence and Nanophotonic Computing, M. Naruse (Ed.), Springer, p. 250, 2014.

2. C. Dwyer and A. Lebeck, *An Introduction to DNA Self-assembled Computer Design*, pp. 212, Artech House Publishing, 2008.

Journal and Refereed Conference Publications

3. S. Wang, A. R. Lebeck, C. Dwyer, Nanoscale Resonance Energy Transfer-based Devices for Probabilistic Computing, *IEEE Micro*, vol. 35, no. 5, 72-84, 2015.
4. J. Pang, C. Dwyer, A. R. Lebeck, *More is Less, Less is More: Molecular-Scale Photonic NoC Power Topologies*, Twentieth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), March 2015.
5. J. Pang, C. Dwyer, A. R. Lebeck, *mNoC: Large Nanophotonic Network-on-Chip Crossbars with Molecular Scale Devices*, *ACM Journal on Emerging Technologies in Computing Systems (JETC)*, August 2015.
6. C. LaBoda, H. Duschl, C. Dwyer, “DNA-Enabled Integrated Molecular Systems for Computation and Sensing”, *Account of Chemical Research*, 47 (6), pp. 1816–1824, 2014.
7. M. Mottaghi, A. Rallapalli, C. Dwyer, “RETLab: A fast design-automation framework for arbitrary RET networks”, *Proceedings of the Design, Automation & Test in Europe Conference (DATE)*, Dresden, March 2014.
8. M. Mottaghi, C. Dwyer, “Thousand-fold increase in optical storage density by polychromatic address multiplexing on self-assembled DNA nanostructures”, *Advanced Materials*, DOI: 10.1002/adma.201301141, 2013.
9. J. Pang, A.R. Lebeck, C. Dwyer, “Modeling and simulation of a nanoscale optical computing system”, *Journal of Parallel and Distributed Computing*, in press, 2013.
10. S. Wang, C. Dwyer, “Laser Remote Sensing Enabled by DNA Self-assembly and Resonance Energy Transfer”, *Proceedings of the Conference on the Foundations of Nanoscience: Self-Assembled Architectures and Devices*, April 2012.
11. M. Mottaghi, C. Dwyer, “Optical Techniques for FRET-based Address Multiplexing”, *Proceedings of the Conference on the Foundations of Nanoscience: Self-Assembled Architectures and Devices*, April 2011.
12. V. Thusu, C. Dwyer, “Markov Model Analysis of Self-Assembled, Label-free Biomolecular Sensors Using Resonance Energy Transfer Logic”, *Proceedings of the Conference on the Foundations of Nanoscience: Self-Assembled Architectures and Devices*, April 2011.
13. C. Pistol, V. Mao, V. Thusu, A.R. Lebeck, C. Dwyer, “Encoded multi-chromophore response for simultaneous label-free detection”, *Small*, vol. 6, no. 7, 843-850, 2010.

14. Y. Liu, C. Dwyer, A. R. Lebeck, "Routing in Self-Organizing Nano-Scale Irregular Networks", *ACM Journal on Emerging Technologies in Computing Systems (JETC)*, 2010.
15. C. Pistol, W. Chongchitmate, C. Dwyer, A. R. Lebeck, "Architectural Implications of Nanoscale Integrated Sensing and Computing", *IEEE Micro*, vol. 30, no. 1, 2010. (**Top Picks from 2009 Computer Architecture Conferences**)
16. V. Mao, V. Thusu, C. Dwyer, K. Chakrabarty, "Connecting fabrication defects to fault models and SPICE simulations for DNA self-assembled nanoelectronics", *IET Computers & Digital Techniques*, vol. 3, no. 6, 553-569, 2009.
17. C. Pistol, C. Dwyer, A. R. Lebeck. "Architectural Implications of Nanoscale Integrated Sensing and Computing", *Proceedings of the 14th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS-XIV)*, 2009.
18. C. Pistol, C. Dwyer, A. R. Lebeck. "Nanoscale Optical Computing using Resonance Energy Transfer Logic", *IEEE Micro*, vol. 28, no. 6, 7-192008.
19. K. Skinner, C. Dwyer, M. R. Falvo, R. M. Taylor, S. Washburn. "Electrical and Mechanical Characterization of Au-CdSe-Au Heterostructured Nanowires", *Proceedings of the Materials Research Society Spring Meeting*, San Francisco, CA, 2008.
20. V. Mao, C. Dwyer, K. Chakrabarty. "Fabrication Defects and Fault Models for DNA Self-Assembled Nanoelectronics", *International Test Conference (ITC)*, Paper 31.1, 2008. (**Selected for Top-10 papers from ITC 2008**)
21. K. Skinner, C. Dwyer, S. Washburn, "Quantitative Analysis of Individual Metal-CdSe-metal Nanowire Field-effect Transistors", *Applied Physics Letters*, vol. 92, no. 11, 112105, 2008.
22. C. Dwyer, C. Pistol, A. R. Lebeck, "Energy Transfer Logic on DNA Nanostructures: Enabling Molecular-Scale Amorphous Computing", *4th Workshop on Non-Silicon Computing (NSC-4)*, ISCA 2007.
23. J. P. Patwardhan, V. Johri, C. Dwyer, A. R. Lebeck, "A Defect Tolerant Self-organizing Nanoscale SIMD Architecture", *ACM Journal on Emerging Technologies in Computing Systems*, vol. 3, no. 2, 1-33, July 2007.
24. C. Pistol and C. Dwyer, "Scalable, Low-cost, Hierarchical Assembly of Programmable DNA Nanostructures", *Nanotechnology*, vol. 18, 125305-9, 2007.
25. K. Skinner, C. Dwyer, S. Washburn, "Selective Functionalization of Arbitrary Nanowires", *Nano Letters*, vol. 6, no. 12, pp. 2758-2762, 2006.
26. J. P. Patwardhan, V. Johri, C. Dwyer, A. R. Lebeck, "A Defect Tolerant Self-organizing Nanoscale SIMD Architecture", *Proceedings of the 12th International Conference on*

Architectural Support for Programming Languages and Operating Systems (ASPLOS-XII), October 2006.

27. J. P. Patwardhan, C. Dwyer, A. R. Lebeck, "Self-Assembled Networks: Control vs. Complexity", *1st International Conference on Nanoscale Networks (NANONET)*, September 2006.
28. J. P. Patwardhan, C. Dwyer, A. R. Lebeck, "Design and Evaluation of Fail-Stop Self-Assembled Nanoscale Processing Elements", *IEEE International Workshop on Design and Test of Defect-Tolerant Nanoscale Architectures (NANOARCH '06)*, June 2006.
29. C. Pistol, A. R. Lebeck, C. Dwyer, "Design Automation for DNA Self-Assembled Nanostructures", *Proceedings of the 43rd Design Automation Conference (DAC)*, July 2006.
30. J. P. Patwardhan, C. Dwyer, A. R. Lebeck, D. J. Sorin, "NANA: A Nano-scale Active Network Architecture", *ACM Journal on Emerging Technologies in Computing Systems*, vol. 2, no. 1, pp. 1-31, January, 2006.
31. S. H. Park, C. Pistol, S. J. Ahn, J. H. Reif, A. R. Lebeck, C. Dwyer, T. H. Labean, "Finite-size, Fully-Addressable DNA Tile Lattices Formed by Hierarchical Assembly Procedures", *Angewandte Chemie*, vol. 45, pp. 735-739, January 2006.
32. C. Dwyer and A. R. Lebeck, "Self-Assembled Computer Architecture", *Systems Self-Assembly: multidisciplinary snapshots*, eds. N. Krasnogor, et al., 2008.
33. C. Dwyer, "Computer-Aided Design for DNA Self-Assembly: Process and Applications", *Proceedings of the IEEE/ACM International Conference on Computer Aided Design (ICCAD)*, pp. 662-667, November 2005. (invited paper)
34. J. P. Patwardhan, C. Dwyer, A. R. Lebeck, D. J. Sorin, "Evaluating the Connectivity of Self-Assembled Networks of Nanoscale Processing Elements", *IEEE International Workshop on Design and Test of Defect-Tolerant Nanoscale Architectures (NANOARCH '05)*, pp. 2.1-2.8, May 2005.
35. C. Dwyer, "A System-level Design Approach to the Evaluation of Self-assembled Computer Architectures", *Proceedings of the 2nd Conference on the Foundations of Nanoscience*, pp. 255-261, April 2005. (invited paper)
36. C. Dwyer, S. H. Park, T. LaBean, A. Lebeck, "The Design and Fabrication of a Fully Addressable 8-tile DNA Lattice", *Proceedings of the 2nd Conference on the Foundations of Nanoscience*, pp. 187-191, April 2005.
37. C. Dwyer, A. Lebeck, D. Sorin, "Self-assembled Architecture and the Temporal Aspects of Computing", *IEEE Computer*, vol. 38, pp. 56-64, January 2005.
38. C. Dwyer, L. Vicci, J. Poulton, R. Taylor, "DNA Self-assembled Parallel Computer Architectures", *Nanotechnology*, vol. 15, pp. 1688-1694, 2004.

39. C. Dwyer, L. Vicci, J. Poulton, D. Erie, R. Superfine, S. Washburn, R. M. Taylor, "The Design of DNA Self-Assembled Computing Circuitry", *IEEE Trans. on VLSI*, vol. 12, pp. 1214-1220, 2004.
40. C. Dwyer, V. Johri, M. Cheung, J. Patwardhan, A. Lebeck, D. Sorin, "Design Tools for a DNA-guided Self-assembling Carbon Nanotube Technology", *Nanotechnology*, vol. 15, pp. 1240-1245, 2004.
41. M. Cheung, C. Dwyer, D. Sorin, "Semi-empirical SPICE Models for Carbon Nanotube FET Logic", *Proceedings of the 4th IEEE Conference on Nanotechnology*, pp. 386-388, 2004.
42. J. Patwardhan, C. Dwyer, A. Lebeck, D. Sorin, "Circuit and System Architecture for DNA-Guided Self-Assembly of Nanoelectronics", *Proceedings of the 1st Conference on the Foundations of Nanoscience*, pp. 344-358, April, 2004.
43. C. Dwyer, R. Taylor, L. Vicci, "Performance Simulation of Nanoscale Silicon Rod Field-Effect Transistor Logic", *IEEE Trans. on Nanotechnology*, vol. 2, no. 2, pp. 69-74, 2003.
44. C. Dwyer, "Self-Assembled Computer Architecture: Design and Fabrication Theory", *Ph.D. dissertation*, supervised by Russell Taylor (adviser), Dorothy Erie, John Poulton, Richard Superfine, Leandra Vicci, and Sean Washburn, May 2003.
45. C. Dwyer, M. Guthold, M. Falvo, S. Washburn, R. Superfine, and D. Erie, "DNA-Functionalized Single-walled Carbon Nanotubes", *Nanotechnology*, vol. 13, pp. 601-604, 2002.
46. C. Dwyer, R. Taylor, L. Vicci, "Transport Simulation of a Nanoscale Silicon Rod Field-Effect Transistor", *Proceedings of the 2nd IEEE Conference on Nanotechnology*, pp. 401-404, 2002.

Contributed Conference Presentations

47. "Engineering Sensor-Actuator Pharmaceuticals by DNA Self-assembly", Cancer Detection & Diagnostics Technologies for Global Health Conference, NIH-National Cancer Institute, August 2011.
48. "Expanding the Computation Domain: Toward Fused Computation and Sensing", Annual Meeting of the Int'l Biological Engineering Society (IBE), March 2009.
49. "Multiplexed Sensing with Resonance Energy Transfer Circuits on Nanoscale DNA Grids", Nanoscale Devices for Defense and Security (Nano-DDS), September 2009.
50. "DNA Self-assembly for Macroscale Manufacturing", Annual Meeting of the Society of Manufacturing Engineers, 2009.
51. "Multi-function DNA Self-assembled Contrast Agents", Nanoscale Devices for Defense and Security (Nano-DDS), Washington DC, June 2007.

52. "Selective Functionalization of Hetero-structured Au-CdSe-Au Nanowires", The 3rd Conference on the Foundations of Nanoscience, April 2006.
53. "The Design and Fabrication of a Fully Addressable 8-tile DNA Lattice", The 2nd Conference on the Foundations of Nanoscience, April 2005.
54. "Semi-empirical SPICE Models for Carbon Nanotube FET Logic", The 4th IEEE Conference on Nanotechnology, August 2004.
55. "CAD Support for DNA-Guided Self-Assembly of Nanoelectronics", The 1st Conference on the Foundations of Nanoscience, April 2004.
56. "Parallel Computer Architectures Enabled by Self-Assembly", The 1st Conference on the Foundations of Nanoscience, April 2004.
57. "Transport Simulation of a Nanoscale Silicon Rod Field-Effect Transistor", The 2nd IEEE Conference on Nanotechnology, August 2002.
58. "Methodology for the DNA-Guided Self Assembly of Novel Computing Circuitry", The 10th Foresight Conference on Molecular Nanotechnology, October 2002.
59. "Self-assembled Carbon Nanotube Circuitry", The 67th Meeting of the Southeastern Section of the American Physical Society, November 2000.

Invited Presentations

60. "Stochastic computation and self-assembled systems", IARPA HPC Workshop, 2013.
61. "DNA nanotechnology and applications", ARO Synthetic Molecular Systems Workshop, April 2012.
62. "Enabling Wide-Area Persistent Surveillance: DNA Self-assembled, Nanoscale Circuits and Logic", DARPA Workshop on Emerging Technology, March 2012.
63. "Self-assembling Materials for Computer Architecture", HPEC 14, MIT Lincoln Lab, September 2011.
64. "Some Assembly Required: Molecular-scale Computing and Sensing Enabled by DNA", Fourth Indo-American Kavli Frontiers of Science Symposium, National Academy of Sciences, April 2011.
65. "DNA Nanotechnology: Devices, Computation, and Sensing"
 - University of Washington, May 2010
 - Nanotechnology Research Institute, 2009
 - SME Nano-manufacturing Technology Group, 2009.
66. "DNA-based Spatial Computing: Toward Diffusion-limited Computation"
 - Spatial Computing Workshop, IEEE-SASO, September 2009.

67. “DNA Self-assembly and Computer System Fabrication”
 - IBM Research – Almaden, June 2008
 - University of Texas at Austin, March 2007
 - University of Washington, January 2007
 - The 73rd Meeting of the Southeastern Section of the American Physical Society, November 2006
 - Tufts University, June 2006
 - Virginia Tech, March / May 2006
 - North Carolina Nanobiotechnology Conference, January 2006.
68. “Computer-Aided Design for DNA Self-Assembly: Process and Applications”
 - The IEEE/ACM International Conference on Computer Aided Design (ICCAD), November 2005.
69. “A System-level Design Approach to Self-assembled Computer Architecture”
 - The 2nd Conference on the Foundations of Nanoscience, April 2005
 - Duke Frontiers, May 2005.
70. “Circuit and System Architecture for the DNA-guided Self-assembly of Nanoelectronics”
 - Air Force Research Laboratory, July 2004.
71. “Self-assembled Computer Architecture”
 - University of California at Berkeley, April 2004
 - Brown University, April 2004
 - Duke University, July 2003 / April 2004
 - North Carolina State University, June 2003.

Advising

1. Vishwa Nellore, Ph.D. thesis, Duke University, 2014.
2. Mohammad Mottaghi, “Design-Automation Tools and Multiplexing Techniques for FRET-Enabled Optical Computing”, Ph.D. thesis, Duke University, 2014.
3. Jun Pang (co-advised), “Chromophore-Based Nanophotonic Network-on-Chip and Computing Systems”, Ph.D. thesis, Duke University, 2013.
4. Viresh Thusu, “Self-Assembled Resonance Energy Transfer Devices”, Ph.D. thesis, Duke University, 2013.
5. Vincent Mao, "The Thermo-Mechanical Dynamics of DNA Self-Assembled Nanostructures", Ph.D. thesis, Duke University, 2010.
6. Constantin Pistol (co-advised), "Structures, Circuits and Architectures for Molecular Scale Integrated Sensing and Computing", Ph.D. thesis, Duke University, 2009.

Funding profile and references available upon request.