Punarbasu Purkayastha

Office Address:
CGG Services (Singapore) Pte. Ltd.,
9 Serangoon North Ave 5,
Singapore – 554531.

Contact:
✉ punarbasu@gmail.com
https://ppurka.github.io

EDUCATION

Ph. D. in Electrical Engineering August 2004 – May 2010
University of Maryland, College Park, USA GPA: 3.91/4.0
Major: Communications, *Thesis title:* Bounds on the Size of Codes, *Advisor:* Prof. Alexander Barg

B. Tech. in Electrical Engineering August 2000 – May 2004
Indian Institute of Technology, Kanpur, India CPI: 9.1/10.0

SKILLS (Representative code at https://github.com/ppurka)

Language: English (*fluent*)

Programming:

- *Proficient*: C, Fortran, Python, MATLAB, Sage Mathematical Software, Unix Utilities and Scripting
- *Intermediate*: C++, CUDA, Cython, OpenMP, Open-MPI
- *Basic*: GAP, HTML, Lua, Rust, SQL

Tools: Arm-DDT, Valgrind, GDB, CUDA-GDB, Perf, Gprof, Intel Vtune, Intel Advisor, Intel Inspector

EXPERIENCE

Senior Software Project Leader at CGG, Singapore January 2022 – present
Project Leader Software Developer at CGG, Singapore January 2018 – December 2021
Senior Software Developer at CGG, Singapore September 2016 – December 2017
Staff Software Developer at CGG, Singapore January 2016 – August 2016
Software Developer at CGG, Singapore September 2014 – December 2015
Accomplishments (Area: High Performance Computing):

- Leading a team of four developers.
- Delivered high quality software for **geophysical signal processing**, under tight deadlines. Developed non-regression tests for the new software developed.
- Optimized CPU code by targeted vectorization, alternative algorithms, and concurrency, achieving speedup of 50% to more than 200%.
- Ported optimized CPU code to CUDA, ensuring near identical results, and achieving speedup of 20 to 25 times.
- Primary developer and support for a specific suite of software that uses Curvelet Transforms for de-noising, for bandwidth extension, and for removing multiples (unwanted secondary seismic signals) from the primary seismic signals. Provided corrected and improved seismic images by using alternative processing methods.
- Skilled in debugging software issues. Provided advice to geophysicists on the proper parameterization of the software, by drawing upon the relevant mathematical theories.
- Development performed primarily on Fortran and C/C++, using CUDA, Open MPI and OpenMP.

Research Fellow at Nanyang Technological University, Singapore August 2010 – August 2014
Accomplished Research (Four International Journal and Six International Conference Publications):

- Constructed new error correction schemes for nonvolatile (flash) memories, optimal linear codes for generalized Hadamard matrices, optimal sequences for frame synchronization in digital communication systems, and new coded modulation schemes for powerline channels (smart grid).

Graduate Research Assistant at University of Maryland, College Park August 2006 – May 2010
Accomplished Research (Two International Journal and Two International Conference Publications):

- Constructed optimal and near optimal codes and sequences in various metric spaces – the Hamming space, constant weight space, and in a generalization of the Hamming space called the ordered Hamming space.

Summer Intern at Qualcomm Flarion Technologies, New Jersey June 2007 – August 2007
Accomplished Research: Determined estimation and coding schemes for a specific wireless communication system.

PUBLICATIONS (Description of research at https://ppurka.github.io/research.html)

Journal:

J1. "Product Construction of Affine Codes," with Yeow Meng Chee, Han Mao Kiah, and Patrick Solé, SIAM Journal on Discrete Mathematics, vol. 29, no. 3, 2015, pp. 1540–1552.

J2. "Importance of Symbol Equity in Coded Modulation for Power Line Communications," with Yeow Meng Chee, Han Mao Kiah, and Chengmin Wang, IEEE Transactions on Communications, vol. 61, no. 10, pp. 4381–4390, October 2013.

J3. "Cross-Bifix-Free Codes Within a Constant Factor of Optimality," with Yeow Meng Chee, Han Mao Kiah, and Chengmin Wang, IEEE Transactions on Information Theory, vol. 59, no. 7, pp. 4668–4674, July 2013.

J4. "Estimates on the Size of Symbol Weight Codes," with Yeow Meng Chee, and Han Mao Kiah, IEEE Transactions on Information Theory, vol. 59, no. 1, pp. 301–314, January 2013.

J5. "Near MDS Poset Codes and Distributions," with Alexander Barg, Error-Correcting Codes, Cryptography and Finite Geometries, Editors: A. Bruen and D. Wehlau, AMS series in Contemporary Mathematics, 2010, vol. 523, pp. 135–148.

J6. "Bounds on Ordered Codes and Orthogonal Arrays," with Alexander Barg, Moscow Mathematical Journal, 2009, vol. 9, no. 2, pp. 211–243.

Conference Proceedings:

C1. "Product Construction of Affine Codes," with Yeow Meng Chee, Han Mao Kiah, and Patrick Solé, IEEE International Symposium on Information Theory (ISIT) 2014, Honolulu, Hawaii, USA, pp. 1441–1445.

C2. "Rewritable Coset Coding for Flash Memories," with Yeow Meng Chee, and Han Mao Kiah, IEEE International Symposium on Information Theory (ISIT) 2014, Honolulu, Hawaii, USA, pp. 2082–2086.

C3. "Matrix Codes and Multitone Frequency Shift Keying for Power Line Communications," with Yeow Meng Chee, and Han Mao Kiah, IEEE International Symposium on Information Theory (ISIT) 2013, Istanbul, Turkey, pp. 2870–2874.

C4. "Efficient Decoding of Permutation Codes Obtained from Distance Preserving Maps," with Yeow Meng Chee, IEEE International Symposium on Information Theory (ISIT) 2012, Boston, MA, USA, pp. 641–645.

C5. "Importance of Symbol Equity in Coded Modulation for Power Line Communications," with Yeow Meng Chee, Han Mao Kiah, and Chengmin Wang, IEEE International Symposium on Information Theory (ISIT) 2012, Boston, MA, USA, pp. 666–670. (*Best Student Paper Award finalist*, Student: Han Mao Kiah)

C6. "Optimal Family of q-ary Codes Obtained from a Substructure of Generalised Hadamard Matrices," with Yeow Meng Chee, and Carl Bracken, IEEE International Symposium on Information Theory (ISIT) 2012, Boston, MA, USA, pp. 116–119.

C7. "Near MDS Poset Codes and Distributions," with Alexander Barg, IEEE International Symposium on Information Theory (ISIT) 2010, Austin, Texas, USA, pp. 1310–1314. (*Best Student Paper Award finalist*)

C8. "Bounds on Ordered Codes and Orthogonal Arrays," with Alexander Barg, IEEE International Symposium on Information Theory (ISIT) 2007, Nice, France, pp. 331–335.

GRADUATE COURSES

University of Maryland, College Park:

Communication and Coding Theory
- Error Correcting Codes
- Advanced Topics in Coding Theory
- Information Theory
- Multiuser Information Theory
- Estimation & Detection Theory
- Random Processes

Mathematics
- Abstract Algebra I
- Probability Theory I
- Fundamental Concepts of Topology

Control Systems
- System Theory
- Optimal Control

Indian Institute of Technology, Kanpur:

- Application of CDMA to Cellular Communications
- Large Deviations & Measures of Information
- Time Series Analysis

HONORS

- Awarded Graduate Fellowship by the University of Maryland, College Park from August 2004 to May 2006.
- Awarded the Certificate of Merit for Academic Excellence for being in the top 10% of students for the year 2000-2001, at Indian Institute of Technology, Kanpur.
- Ranked 11th out of over 100,000 examinees in the state-wide matriculation (high school) examination in 1997 conducted by the Board of Secondary Education Assam, India.

PROFESSIONAL SERVICE AS REVIEWER

- Advances in Mathematics of Communications (2011)
- Cryptography and Communications - Discrete Structures, Boolean Functions and Sequences (2015)
- Designs, Codes and Cryptography (2011)
- Electronic Journal of Combinatorics (2009)
- IEEE Communications Letters (2014)
- IEEE Information Theory Workshop (ITW) (2011, 2015)
- IEEE International Symposium on Information Theory (ISIT) (2009, 2012–2014, 2016–2017, 2019)
- IEEE Transactions on Communications (2008)
- IEEE Transactions on Information Theory (2007, 2009, 2011–2019)
- SIAM Journal on Discrete Mathematics (2013)

PROFESSIONAL MEMBERSHIP

- Member, IEEE (2010 – present)

OTHER SCIENTIFIC AND SOCIETAL IMPACT

- Developer of the Sage Mathematical Software (2011–2014)
- Mentor for Google Summer of Code 2013 (under the Sage organization)

TEACHING EXPERIENCE

Nanyang Technological University, Singapore:

- Laboratory Assistant for a "Making and Tinkering" project based summer course for selected first and second year undergraduate students in Summer 2014. Guided students primarily on the design and use of 3D printing technologies.
- Co-instructor for Algorithms & Computing III, a course for modeling problems, and teaching mathematics through programming and visualization, for second year undergraduates, from August 2013 to December 2013 (in MATLAB), August 2012 to December 2012 (in MATLAB), and from August 2011 to December 2011 (in Sage/Python). Conducted lectures, weekly laboratory sessions, and involved in designing course material, projects, and exam questions.
- Teaching assistant for undergraduate courses such as Calculus and Linear Algebra. Conducted weekly discussion sessions.

University of Maryland, College Park:

- Conducted weekly discussion sessions for second year and third year undergraduate students in Signals and Systems, and Numerical Techniques in Engineering.
- Conducted weekly laboratory sessions on analog and digital circuits for second year and third year students in undergraduate courses on Circuit Design Laboratory.

TALKS

- "Rewritable Coset Coding for Flash Memories," IEEE International Symposium on Information Theory (ISIT) 2014, Honolulu, Hawaii, USA, July 2014.
- "Matrix Codes and Multitone Frequency Shift Keying for Power Line Communications," IEEE International Symposium on Information Theory (ISIT) 2013, Istanbul, Turkey, July 2013.
- "Efficient Decoding of Permutation Codes Obtained from Distance Preserving Maps," IEEE International Symposium on Information Theory (ISIT) 2012, Boston, MA, USA, July 2012.
- "Bounds on Constant Weight Codes," Nanyang Technological University, Singapore, January 2011.

- "Near MDS Poset Codes and Distributions," IEEE International Symposium on Information Theory (ISIT) 2010, Austin, Texas, USA, June 2010.
- "Bounds on the Size of Ordered Codes and Ordered Orthogonal Arrays," United States Naval Academy, USA, November 2007.