

# Benjamin Michalowicz

PhD Student, The Ohio State University

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📍 Columbus, Ohio, USA

## Education

**PhD, Computer Science and Engineering**, The Ohio State University, Columbus, OH 08/21 - Present

**Advisor:** Dr. Dhabaleswar K. (DK) Panda

**Research Interests:** High-Performance Computing, Parallel Programming Models, Computer Architecture, Parallel Architectures, Virtualization, Heterogeneous HPC Environments

**Relevant Coursework:** Advanced Operating Systems, Introduction to High-Performance Deep Learning, Network-based HPC, Algorithms, Computability and Complexity, Intro to Parallel Programming, Advanced Computer Architecture, Intro to Data Mining, Compiler Design and Implementation

**MS, Computer Science (5-year BS/MS Program)**, Stony Brook University, Stony Brook, NY 08/19 - 05/21

**Relevant Coursework:** Principles of Programming Languages, System Security, Data Science Fundamentals, Analysis of Algorithms, Quantum Computing and Applications, Fundamentals of Computer Networks, Computational Geometry

**Advisor:** Dr. Barbara Chapman

**Activities:** SBUHacks Organizing Committee, Marching Band, Research

**BS, Computer Science**, Stony Brook University, Stony Brook, NY 08/16 - 05/20

**Relevant Coursework:** Principles of Programming Languages, Systems Fundamentals I/II, Operating Systems, Principles of Database Systems, Advanced Systems Programming in Unix/C, Algorithms, Calculus I-III, Linear Algebra, Theory of Computation

**Activities:** Marching Band, Research, SBCS, SBLive, TKD @ SBU

## Experience

**Research Assistant**, The Ohio State University, Columbus, OH 05/2021–Present

High-Performance Computing research in Dr. DK Panda's [Network-Based Computing Laboratory](#). Focuses: Further understanding low-level transfer methods – the Open Fabrics Interface, IB-Verbs, and offloading communication to other hardware such as SmartNICs/DPUs

**Research Intern**, Los Alamos National Lab 05/2023–08/2023

Remote/Los Alamos, NM  
Research in Edge Devices and SmartNICs under the direction of Dr. Stephen Poole. Emphasis on optimizing both communication and computational offload to these devices for traditional HPC and ML/DL workloads.

**Teaching Assistant**, The Ohio State University, Columbus, OH 08/2021–12/2021  
Grader for CSE 4471: Information Security.

**Percussion Teacher/Drumline Instructor** 05/2021–08/2021  
Park Ridge, NJ

Working with the Park Ridge Jr./Sr. High School Marching Band's drumline on their 2021-22 halftime show: wrote drumline parts, held weekly rehearsals, and taught marching fundamentals. Also taught drum lessons to beginner, intermediate, and advanced players, in rudiments and their applications to the drum set, drumming dexterity, and advanced techniques

**Social Media Manager**, SBUHacks Organizing Committee, Stony Brook, NY 03/2020–08/2021

Kept social media accounts up to date (Instagram, Twitter, Facebook, etc.) and otherwise helping organize the SBUHacks hackathon for the 2020 MLH season; helped successfully run Stony Brook's first-ever, student-run, virtual hackathon.

**Research Assistant**, Stony Brook University, Stony Brook, NY 08/2020–05/2021

High-Performance Computing research in Dr. Barbara Chapman's [Exascalelab](#), focusing on testing and benchmarking new HPC clusters and architecture. Ran acceptance tests and helped debug the configuration of the new Ookami cluster. Used code profilers to obtain exact behavior of performance across different HPC processor architectures. Studied/currently studying the effects of compiler toolchains and OpenMP on different applications on the A64FX processor

**Teaching Assistant**, Stony Brook University, 08/2020–  
Stony Brook, NY 05/2021

**Fall 2020:** Held weekly office hours, led weekly recitations, and helped students understand material in Stony Brook University's [CSE 216](#) course (Programming Abstractions). Designed recitation questions and collaborated with the course lecturer. Helped grade exams homework assignments, and led exam reviews outside of class. Kept in contact with students to answer conceptual and assignment questions.

**Spring 2021:** Held weekly office hours and collaborated on designing homework test cases and exam questions with the professor and fellow TA's for CSE 320: Systems Fundamentals II.

**Software Technical Intern**, BAE Systems, 05/2019–  
Totowa, NJ 08/2019

Worked with full-time employees to re-design a code generation tool from interface definition files with a backing symbol table in C#. Allowed for optimization and easier redesign for larger files. Created a Common Language Runtime Environment for generated objects to communicate via C# and C++. Worked with fellow interns to redesign the mentor/mentee program for incoming interns and YearOne employees.

**Undergraduate Teaching Assistant**, Stony Brook University, 01/2019–  
Stony Brook, NY 12/2019

Held weekly office hours, led weekly recitations, and helped students understand material in Stony Brook University's [CSE 216](#) course (Programming Abstractions).

**Undergraduate Research Assistant**, Stony Brook University, 05/2018–  
Stony Brook, NY 05/2019

Worked with PhD students in the [COMPAS lab](#) on projects focusing on microarchitecture and cloud infrastructure. Specifically, I primarily used C and C++ for microarchitectural components (see [Projects](#) below), and JavaScript for verifying cloud benchmarks.

**SOSB Summer Recruitment Staff**, Stony Brook University, 04/2018–  
Stony Brook, NY 08/2018

Aided in recruitment for the 2018-2019 Season. Assisted in planning for band camp, football games, and half-time shows for fall 2018. Helped organize funds, set up equipment to be ordered, cleaned instruments, and encouraged incoming undergraduate students to join The Spirit Of Stony Brook.

**Master @ Master Yoo's Summit Martial Arts**, 06/2012–  
Park Ridge, NJ 08/2017

Led classes of all ranked levels, from beginner to 2nd degree black belt; taught sparring, blocking/striking techniques, self-defense, and weapon techniques while keeping a safe environment for students.

## Projects

**DPU-Bench** 01/2023–  
Columbus, OH Present

Developing and enhancing a microbenchmark suite to measure the offload efficiency of SmartNICs such as NVIDIA's BlueField DPUs. The goal is to enable this to work on any scale-up/out parallel programming model such as MPI and SHMEM. See [\[1\]](#) for more details.

**Ookami/A64FX Research:** Studying the FLASH code 03/2021–  
Stony Brook, NY 07/2021

Collaborated with astrophysicists at the [Institute for Advanced Computational Science](#) studying [FLASH](#): a multi-scale/multi-physics application written in Fortran. Analyzed memory constraints of FLASH through experiments revolving around 2D and 3D simulations.

**Ookami/A64FX Research:** Behavior analysis of the A64FX through OpenMP & MPI 08/2020–  
Stony Brook, NY 05/2021

Tasked with helping run acceptance tests on the [Ookami Cluster at Stony Brook University](#) just after it had finished being installed, and repeated similar experiments on the [Fugaku Supercomputer](#), analyzing OpenMP and MPI libraries and their behavior as well as examine several compiler toolchains and their abilities to optimize runtime, performance, and general efficiency of applications.

**Chor-DNS:** Implementation for Chord-based DNS Resolution | Data Management, Integration 10/2020–  
Stony Brook, NY 12/2020

**Course Project:** Implemented the Chord Ring structure with Python/DistAlgo for DNS resolution and compared runtimes to queries made through Linux's `dig` and homemade DNS resolvers. Github link: <https://github.com/BTMichalowicz/CSE534-ChorDNS>

**Topologic:** Library to Simulate DFAs | Co-Developer 06/2020–  
Park Ridge, NJ 08/2020

Simulates DFAs and Probabilistic NFAs using context switching. Programs can start at multiple vertices, which may be run in parallel using POSIX Threads and Mutexes in C. Github project: <https://github.com/mstern98/Topologic>

**FeS2/SIMICS simulation research:** COMPAS lab Research Project 05/2018–  
Stony Brook, NY 12/2019

Studied the FeS2 simulator platform and the SIMICS x86 processor simulator to model its configuration to real processors. Using C/C++, I debugged the cycle-accurate platform to enable checkpoints of benchmark applications to run for durations over one billion clock cycles.

## Service to Computer Science

**SpecHPC** Assistant Contributor to SPECchpc 2021 2020-2021

Aided in testing and verification during the development of SPECchpc2021, under the direction of Anthony Curtis (Stony Brook University). Mr. Curtis later received a contributor award in January 2022 from SPEC.

**SC'2021:** Virtual Student Volunteer 11/2021

Helping the virtual aspect of SuperComputing 2021 run smoothly in its attempt at a hybrid conference. Checked in with session chairs, helped fellow volunteers, and ensured that online sessions would start, run, and end smoothly. Recognized as one of the top Student Volunteers.

**SCinet Volunteer,** SC '22 Conference 11/2022

Member of the Volunteer Services team. Aided in the setup and monitoring of SC 22's massive infrastructure along with fellow students and professional staff from both industry and academia. Specific Team(s): Edge/Wireless

**PC Member, Artifact Evaluation,** CC '23 01/2023

Member of the Artifact Evaluation Committee for the International Conference on Compiler Construction (CC) 2023. Reviewed artifacts submitted by authors on compiler optimizations and strategies for usability and reproducibility.

**SCinet Volunteer,** SC '23 Conference 11/2023

Member of the Volunteer Services team. Aided in the setup and monitoring of SC 23's massive infrastructure along with fellow students and professional staff from both industry and academia. Specific Team(s): Fiber, Edge/Wireless

**PC Member, Artifact Evaluation,** CC '24 01/2024

Member of the Artifact Evaluation Committee for the International Conference on Compiler Construction (CC) 2024. Reviewed artifacts submitted by authors on compiler optimizations and strategies for usability and reproducibility.

## Technologies

MPI, OpenMP, Git, Slurm, Various Compiler Toolchains (Intel, LLVM, GNU, Cray, Fujitsu, ARM), TAU, NVIDIA Nsight

## Programming Languages

C, C++, Java, Python, OCaml, C#, Fortran, MySQL, MIPS Assembly,  $\LaTeX$

## Personal Interests

Drumming, Computer Science, Martial Arts, Languages (Programming and Natural), music of all types/theory/history

## Non-technical skills

## Drums and assorted percussion

2007-Present

- Formal training in jazz, rock, marching, and orchestral drumming. I am also a private teacher by request and have experience teaching drums to all ages and skill levels in the aforementioned styles.  
- I was the snare-line section leader for the Spirit of Stony Brook Marching Band between 2017-2020 and played in several ensembles since 2011.

## 4th Degree Black Belt in TaeKwonDo

As of December 2015, I hold a 4th-degree black belt (and the rank of "Master") in Tae Kwon Do.

## Awards

### International Symposium on Computer Architecture

06/2019

Phoenix, AZ

A fully funded stipend to ISCA 2019 and its new undergraduate workshop in Computer Architecture (uArch).

### John J. Leddy Director's Award, SOSB Marching Band

05/2020

Given for displaying Academic Excellence, Musical Leadership, Creativity, and Commanding Exceptional Attention in Rehearsal and Performance.

### Shirley Strum Kenney Founder's Award, SOSB Marching Band

05/2018

Given for displaying the leadership and musical qualities and skills of some of the original founding members in SOSB #1 in 2006.

### Student Volunteer Recognition, SC '21 Conference

11/2021

Recognized as one of the top Student Volunteers for keeping multiple lines of communication open and ensuring virtual sessions ran smoothly.

## Publications

### Journal Articles

- [1] Accelerating Communication with Multi-HCA Aware Collectives in MPI  
T. Tran, B. Ramesh, B. Michalowicz, M. Abduljabbar, H. Subramoni Aand D. Panda  
*Concurrency and Computation: Practice and Experience (CCPE)* (July 2023)

## Conferences and Workshops

- [1] Battle of the BlueFields: An In-Depth Comparison of the BlueField-2 and BlueField-3 SmartNICs  
Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, Dhableswar K. DK Panda, Steve Poole  
*2023 IEEE Symposium on High-Performance Interconnects (HOTI)*, 2023  
DOI: [10.1109/HOTI59126.2023.00020](https://doi.org/10.1109/HOTI59126.2023.00020)
- [2] DPU-Bench: A Micro-Benchmark Suite to Measure Offload Efficiency Of SmartNICs  
Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, Dhableswar Panda, Steve Poole  
*Practice and Experience in Advanced Research Computing*, 2023, Association for Computing Machinery  
DOI: [10.1145/3569951.3593595](https://doi.org/10.1145/3569951.3593595)  
URL: <https://doi.org/10.1145/3569951.3593595>
- [3] Enabling Reconfigurable HPC through MPI-Based Inter-FPGA Communication  
Nicholas Contini, Bharath Ramesh, Kaushik Kandadi Suresh, Tu Tran, Ben Michalowicz, Mustafa Abduljabbar, Hari Subramoni, Dhableswar Panda  
*Proceedings of the 37th International Conference on Supercomputing*, 2023, Association for Computing Machinery  
DOI: [10.1145/3577193.3593720](https://doi.org/10.1145/3577193.3593720)
- [4] In-Depth Evaluation of a Lower-Level Direct-Verbs API on InfiniBand-based Clusters: Early Experiences  
B. Michalowicz, K. Suresh, B. Ramesh, A. Shafi, H. Subramoni, M. Abduljabbar, DK Panda  
*The 25th Workshop on Advances in Parallel and Distributed Computational Models (Held in Conjunction With the IPDPS '23)*, 2023
- [5] A Novel Framework for Efficient Offloading of Communication Operations to Bluefield SmartNICs  
K. Suresh, B. Michalowicz, B. Ramesh, N. Contini, J. Yao, S. Xu, A. Shafi, D. Panda  
*The 37th IEEE International Parallel & Distributed Processing Symposium (IPDPS '23)*, 2023
- [6] Efficient Personalized and Non-Personalized Alltoall Communication for Modern Multi-HCA GPU-Based Clusters  
K. Suresh, A. Paniraja Guptha, B. Michalowicz, B. Ramesh, M. Abduljabbar, A. Shafi, DK Panda  
*29th IEEE International Conference on High Performance Computing, Data, and Analytics*, 2022

- [7] Designing Hierarchical Multi-HCA Aware Allgather in MPI  
A. Tran, B. Michalowicz, B. Ramesh, H. Subramoni, A. Shafi, DK Panda  
*Fifteenth International Workshop on Parallel Programming Models and Systems Software for High-End Computing (P2S2), In Conjunction With ICPP 2022: The 51st International Conference on Parallel Processing, 2022*
- [8] Experiences with Porting the FLASH Code to Ookami, an HPE Apollo 80 A64FX Platform  
C Feldman, B Michalowicz, E Siegmann, A Curtis, A Calder, R Harrison  
*International Workshop on Arm-based HPC: Practice and Experience (2022)*
- [9] Comparing OpenMP Implementations with Applications across A64FX Processor Platforms  
Benjamin Michalowicz, Eric Raut, Yan Kang, Tony Curtis, Dossay Oryspayev, Barbara Chapman  
*17th International Workshop on OpenMP, 2021*
- [10] Comparing the behavior of OpenMP Implementations with Various Applications on two Different Fujitsu A64FX Platforms  
Benjamin Michalowicz, Eric Raut, Yan Kang, Tony Curtis, Dossay Oryspayev, Barbara Chapman  
*Practice and Experience in Advanced Research Computing (PEARC) (2021)*
- [11] Ookami: Deployment and Initial Experiences  
Andrew Burford, Alan Calder, David Carlson, Barbara Chapman, Firat Coskun, Tony Curtis, Catherine Feldman, Robert Harrison, Yan Kang, Benjamin Michalowicz, Eric Raut, Eva Siegmann, Daniel Wood, Robert DeLeon, Mathew Jones, Nikolay Simakov, Joseph White, Dossay Oryspayev  
*Practice and Experience in Advanced Research Computing (PEARC) (2021)*

## Invited Talks

- [1] Benjamin Michalowicz, *MVAPICH User Group (MUG) 2023 Conference* "DPUBench: A New Microbenchmark Suite to Measure the Offload Efficiency of SmartNICs (Lightning Talk, presentation of [1])  
August 21, 2023
- [2] Benjamin Michalowicz *OpenSNAPI Consortium*. "DPUBench: A New Microbenchmark Suite to Measure Offload Efficiency of SmartNICs" (presentation of [1])  
June 12, 2023
- [3] Benjamin Michalowicz, Yan Kang. *IACS Student Seminar*. "Studying OpenMP Behavior on the A64FX Processor"  
Apr. 1, 2021
- [4] Catherine Feldman, Benjamin Michalowicz, Alan Calder. *ACM Frontiers in Computing*. "Lessons Learned: An In-Depth Look at Running FLASH on Ookami"  
May 11-13, 2021

## Posters

- [1] Benjamin Michalowicz, Andrew McNamara, Daniel Y. Hwang, and Jose Ortiz; *Chesapeake Large Scale Analytics Conference*. "Fully Homomorphic Schemes For Real-World Usage"  
October 30 - Nov 2, 2023