Maximilian H. Bremer

CONTACT
INFORMATION

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EDUCATION

University of Texas at Austin,
Oden Institute for Computational Engineering and Sciences

Ph.D. Computational Science, Engineering, and Mathematics. August 2020.
M.Sc., Computational Science, Engineering, and Mathematics, May 2018.
Thesis: Task-Based Parallelism for Hurricane Storm Surge
Advisor: Clint Dawson

University of Cambridge,

M.A.St., Part III Pure Mathematics, June 2015.
Emphasis: Partial Differential Equations / Analysis

The University of Texas at Austin

B.Sc., Aerospace Engineering, May 2014, GPA: 3.98/4.00.
B.Sc., Applied Mathematics, May 2014, GPA: 3.98/4.00.

RESEARCH
EXPERIENCE

Keywords

Task-based parallelism • High performance computing • Discontinuous Galerkin finite elements
• Shallow water equations • Hurricane storm surge

Lawrence Berkeley National Lab   Fall 2020–present
Computer Architecture Group   *Supervised by:* Cy Chan and John Shalf

The University of Texas at Austin   Fall 2015–Fall 2020
Computational Hydraulics Group   *Supervised by:* Clint Dawson

‡ Compared and analyzed performance of flat (non-blocking) MPI versus an HPX-based parallelization on Knights Landing and Skylake architectures on Stampede2.
‡ Performed roofline analyses and implemented vectorization strategies that accelerated the code by 2.9x.
‡ Refactored in-house discontinuous Galerkin storm surge code to improve productivity. Introduced software engineering best practices, e.g. continuous integration and unit testing.

Lawrence Berkeley National Lab   Summer 2019
Computer Architecture Group   *Supervised by:* Cy Chan

‡ Designed timestepping strategies that adaptively refine and coarsen timesteps to ensure that cells optimally satisfy the CFL condition.
‡ Leveraged existing speculative parallel discrete event simulation techniques to efficiently parallelize the code.

Lawrence Berkeley National Lab   Summer 2016
Computer Architecture Group   *Supervised by:* Cy Chan

‡ Explored load balancing strategies for asynchronously run hurricane storm surge simulations.
‡ Developed and validated a discrete event simulator of the application code for rapid prototyping of load balancing strategies.

Journal Articles

4. **M.B.**, John Bachan, Cy Chan, Clint Dawson, "Performance Analysis of Speculative Parallel Adaptive Local Timestepping for Conservation Laws", *Submitted to ACM Transactions on Modeling and Computer Simulation*, 2021.

3. Chao Zhang, **M.B.**, Cy Chan, John Shalf, Xiaochen Guo, "ASA: Accelerating Sparse Accumulation in Column-wise SpGEMM", *Submitted to ACM Transactions on Architecture and Code Optimization*, 2021.

2. **M.B.**, John Bachan, Cy Chan, Clint Dawson, "Adaptive Total Variation Stable Local Timestepping for Conservation Laws", *Submitted to Journal of Computational Physics*, 2020, arXiv:2003.09020 [math.NA].

1. **M.B.**, Kazbek Kazhyken, Hartmut Kaiser, Craig Michoski, Clint Dawson, "Performance Comparison of HPX Versus Traditional Parallelization Strategies for the Discontinuous Galerkin Method", *J. Sci. Comput.*, May 2019, doi:10.1007/s10915-019-00960-z.

Conference Papers

3. Md Abdul Motaleb Faysal, Shaikh M. Arifuzzaman, Cy Chan, **M.B.**, Doru Popovici, John Shalf, "HyPC-Map: A Hybrid Parallel Community Detection Algorithm Using Information-Theoretic Approach", *IEEE High Performance Extreme Computing Conference (HPEC 21)*, Boston, MA, IEEE, September 21, 2021, 8 pages.

2. **M.B.**, John Bachan, Cy Chan, Clint Dawson, "Speculative Parallel Execution for Local Timestepping", *2021 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation (SIGSIM-PADS'21)*, Virtual Event USA, ACM, June 1, 2021, 11 pages.

1. **M.B.**, John Bachan, Cy Chan, "Semi-Static and Dynamic Load Balancing for Asynchronous Hurricane Storm Surge Simulations", *2018 IEEE/ACM Parallel Applications Workshop, Alternatives To MPI (PAW-ATM)*, Dallas, TX, IEEE, November 16, 2018, 13 pages.

Presentations/Talks

13. **M.B.**, Cy Chan, John Bachan, Clint Dawson, "Adaptive Local Timestepping and its Parallelization", *SIAM Conference on Parallel Processing for Scientific Computing (PP20)*, February 15, 2020.

12. **M.B.**, Cy Chan, John Bachan, Clint Dawson, "Adaptive Local Timestepping for Shallow Water Flows", 18th *International Workshop on Multi-scale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics (IMUM)*, September 26, 2019.

11. Clint Dawson, **M.B.**, "Vectorization of Discontinuous Galerkin Schemes for Shallow Water Flows", *U.S. National Congress on Computational Mechanics*, July 31, 2019.

10. **M.B.**, "Simulation of Shallow Water Flows Using HPX", *DOE CSGF Program Review*, July 15, 2019.

9. **M.B.**, Hartmut Kaiser, Clint Dawson, "Asynchronous Finite Element Simulation of Coastal Inundation", *SIAM Conference on Computational Science and Engineering (CSE19)*, February 28, 2019.

8. **M.B.**, John Bachan, Cy Chan, "Semi-Static and Dynamic Load Balancing for Asynchronous Hurricane Storm Surge Simulations", *2018 IEEE/ACM Parallel Applications Workshop, Alternatives To MPI (PAW-ATM)*, November 16, 2018.

7. **M.B.**, Kazbek Kazhyken, Hartmut Kaiser, Craig Michoski, Clint Dawson, "Task-based Parallelism for Finite-Element Models of Shallow Water Flows", *World Congress in Computational Mechanics*, July 24, 2018.

6. **M.B.**, "Computational Modeling of Hurricane Storm Surge", *Harrington Annual Research Symposium*, April 10, 2018.

5. **M.B.**, Zach Byerly, Hartmut Kaiser, Craig Michoski, Clint Dawson, "Performance Comparison of HPX versus Traditional Parallelization Models for Finite-Element Models of Environmental Flows", *American Meteorological Society Annual Meeting*, January 10, 2018.

4. **M.B.**, "Wrangling Concurrency with HPX", *ICES Seminar–Student Forum*, December 8, 2017.

3. **M.B.**, Craig Michoski, Zach Byerly, Hartmut Kaiser, Clint Dawson, "Optimizing Discontinuous Galerkin Finite Element Kernels on Knights Landing Chips", *Texas Applied Mathematics and Engineering Symposium*, September 22, 2017.

2. **M.B.**, John Bachan, Cy Chan, "Asynchronous Load Balancing for Hurricane Storm Surge Sim-

ulations", *LBL Computing Sciences Seminar*, February 16, 2017.

1. **M.B.**, Clint Dawson, Zach Byerly, Hartmut Kaiser, Craig Michoski, Andreas Schäfer, "Application of High Performance ParallelX (HPX) for High Performance Computing of Hurricane Storm Surge", *American Meteorological Society Annual Meeting*, January 25, 2017.

HONORS AND AWARDS	*Honors and Awards*

Department of Energy Computational Science Graduate Fellowship (2015)
Donald D. Harrington Fellowship (2015)
Cockrell School of Engineering Outstanding Scholar/Leader Award (2014)
Graham F. Carey Scholarship in Computational Science (2013)

COMPUTER SKILLS

Languages

‡ C++, Python, Bash Scripting, FORTRAN, MatLab, LaTeX

Software Development
DGSWEM-v2 `https://github.com/UT-CHG/dgswemv2`

‡ Discontinuous Galerkin (DG) finite element code for the simulation of coastal flows.
‡ Provides MPI+OpenMP and HPX parallelization back-ends.
‡ License: MIT

Areas of Exposure

‡ *Packages*: MPI, OpenMP
‡ *Libraries*: HPX, Eigen, Blaze, UPC++
‡ *Software Engineering*: git, make, cmake, CircleCI, Docker

ACADEMIC SERVICE

Conferences/Seminars Organized

‡ Co-organizer, *ICES Seminar–Babuška Forum*   Fall 2018–Spring 2019
‡ Co-organizer, *Texas Applied Mathematics and Engineering Symposium*   September 2017

Societal Membership

‡ CSEM Student Representative   Fall 2018–Spring 2019
‡ Society for Industrial and Applied Mathematics (SIAM)

Reviewer, Journal Articles

‡ Computer Methods in Applied Mechanics and Engineering
‡ Journal of Computational Physics