

# Maximilian H. Bremer

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## CONTACT INFORMATION

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## EDUCATION

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

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

### **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

### **The University of Texas at Austin**

#### *Computational Hydraulics Group*

Fall 2015–present

*Supervised by:* Clint Dawson

- ‡ Developing dynamic load balancing strategies using HPX's Active Global Address Space (AGAS) to offset load imbalances generated by the simulation of inundation caused by hurricane storm surge.
- ‡ Compared and analyzed performance of flat (non-blocking) MPI versus an HPX-based parallelization on Knights Landing and Skylake architectures on Stampede2.
- ‡ 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**

#### *Computer Architecture Group*

Summer 2016

*Supervised by:* Cy Chan

- ‡ Examined load balancing strategies for asynchronous execution models of hurricane storm surge simulations.
- ‡ Developed and validated a discrete event simulator of the application code for rapid prototyping of load balancing strategies.

## PUBLICATIONS

### *Journal Articles*

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*

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, Texas, IEEE, November 16, 2018, 13 pages.

## *Presentations/Talks*

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*, 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 Simulations”, *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, L<sup>A</sup>T<sub>E</sub>X

### *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–present  
 ‡ Co-organizer, *Texas Applied Mathematics and Engineering Symposium* September 2017

### *Societal Membership*

‡ CSEM Student Representative Fall 2018–present

‡ Society for Industrial and Applied Mathematics (SIAM)

*Reviewer, Journal Articles*

‡ Computer Methods in Applied Mechanics and Engineering

‡ Journal of Computational Physics