

Objective

To attain a postdoctoral research position related to numerical methods.

Education

Ph.D. Studies, Computer Science (9/05 - Present)

- The University of Chicago; Chicago, IL
- Focus on numerical methods for partial differential equations.
- **Thesis Title:** *Fast Numerical Methods and Biological Problems*
- **Expected Graduation Date:** 8/11

M.S., Computer Science (9/05 - 2/08)

- The University of Chicago; Chicago, IL
- **Thesis:** *Enabling Unstructured Multigrid Under The Sieve Framework*

B.S., Computer Science (8/01 - 5/05)

- Pennsylvania State University; University Park, PA
- Undergraduate Minors in Physics and Mathematics

Research Experience

Research Assistant, University of Chicago - Chicago, IL (9/05 - present)

- novel mesh representation for finite element methods
- optimal mesh grading for rapidly-dying functions
- nonlocal models for implicit solvation

Givens Associate, Argonne National Lab - Argonne, IL (6/06 - 9/06)

- geometric unstructured multigrid methods
- geometry representation within the PETSc linear algebra package

Visiting Positions

Scientific Programmer, Simula Research Lab. - Fornebu, Norway - (6/08 - 9/08)

- automated finite element methods and mesh representation

Visiting Student, University of Minnesota - Minneapolis, MN (9/08 - 6/09)

- Institute for Mathematics and its Applications
- *Mathematics and Chemistry* thematic year
- numerical methods for the Schrödinger equation

Visiting Researcher, Royal Technical Institute - Stockholm, Sweden (6/09 - 9/09)

- isoparametric finite element methods for turbulent bluff-body problems
- goal-oriented *a posteriori* error estimators with geometry error

Other Experience

Scientific Programmer, ASCI FLASH - Chicago, IL (3/07 - 12/07)

- fast multilevel algorithms for astronomical simulations
- debugging highly-parallel large-scale application codes

Presentations

P. Brune, M. Knepley, *A Topologically-Inspired Approach to Geometric Unstructured Multigrid*, US-NCCM9, San Francisco, CA, 2007

P. Brune, M. Knepley, *Geometric Multigrid on Interesting Meshes*, AMS Spring Central Section Meeting, Bloomington, IN, 2008

P. Brune, *Dimension Independent FEM*, FEniCS 09, Oslo, Norway, 2009

P. Brune, J. Hoffman, J. Jansson, *Automating Parametric Geometry using FEniCS Tools*, FEniCS 10, Stockholm, Sweden, 2010

D. Xie, P. Brune, Y. Jiang, L. R. Scott, *Finite Element Analysis and a Fast Solver Approach to a Nonlocal Dielectric Continuum Model*, Poster, IMA Fast Solution Techniques Workshop, Minneapolis, MN, 2010

Publications

P. Brune, M. Knepley, L. R. Scott, *Unstructured Geometric Multigrid in Two and Three Dimensions on Complex and Graded Meshes*, in preparation

P. Brune, M. Knepley, *Fast Reparametrized Approach for Approximating the Reference Density in Classical Density Functional Theory*, in preparation

Peter Brune, L. R. Scott, M. Knepley, *Exponential Grids in High-Dimensional Space*, in preparation

Teaching Experience

Teaching Assistant, University of Chicago

- (*spring 2008*): **Computer Architecture**, graduate and undergraduate
 - proofreading and grading assignments
 - developing and delivering supplemental lectures on digital circuitry
- (*fall 2009*): **Computer Architecture**, graduate and undergraduate
 - grading of assignments and office hours

Skills and Interests

Research Interests:

- **Numerical Methods:**
 - Geometric Multigrid Methods
 - Automated Finite Element Methods
 - Mesh Generation and Mesh Quality
 - Fast Methods for Integral Equations
- **High-Performance Computing:**
 - GPU-Accelerated Computation
- **Application Areas:**
 - Implicit Solvation
 - Classical Density Functional Theory
 - Computational Quantum Chemistry
 - Computational Fluid Dynamics

Programming Skills:

- *Programming Languages:* C++, C, Python, Fortran
- *Scientific Programming:* FEniCS, PETSc
- *Parallel Computing:* MPI, CUDA
- *Markup and Publishing:* HTML, CSS, L^AT_EX