

## Jung-Han Kimn

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**Visa Status :** US Permanent Resident

### Education

- 09/95 - 05/01 Ph.D. in mathematics ( Advisor : Olof B. Widlund )  
Courant Institute of Mathematical Sciences at New York University.  
03/92 - 02/94 M.S. in Mathematics, Seoul National University.  
03/86 - 02/92 B.A. in Mathematics, Yonsei University (1989 - 1990 leave of absence).

### Employment and Duties of Employment

- 08/03 - present **Postdoctoral Associate**, Department of Mathematics and  
The Center for Computation and Technology (CCT),  
Louisiana State University

### Research :

- Developed a convergence theory of optimized Schwarz methods.
- Developed mathematical analysis and practical implementation of *overlapping balancing method* and variants of several numerical techniques with Professor Sarkis, IMPA, Brazil and Mathematical Sciences Department, WPI.

This research has resulted in one of the most efficient algorithms for Helmholtz and Elliptic equations and a theoretical analysis of their convergence.

- Developed scalable parallel codes used for large scale linear elasticity problems using a two-level domain decomposition method including *overlapping balancing method* and several programming toolkits including PETSc (the Portable, Extensible Toolkit for Scientific Computation), MPI (Message Passing Interface), Exodus (Data file pre and post processor), Cubit (Mesh generator), and METIS (Multilevel partitioning) with Professor Bourdin, Department of Mathematics, LSU.
- Built efficient parallel scalable solvers based domain decomposition methods for Cactus Computational Fluid Dynamics (CFD) Toolkit.  
Joint work with Cactus CFD Toolkit Group of CCT.
- Developed Space-Time finite element methods for the nonlinear Wave equations.  
Time-Parallel implicit 3 + 1 dimension simulation using 4 dimension finite elements.  
Joint work with Dr. Matthew Anderson, the Department of Physics, LSU.

- Developed numerical model in the project *Fluid Model for High Speed Networks and Planetary Scale Wireless Sensor and Actuator Networks (PWSANs)*  
Joint work with Professor Park's research group, the Dept. of Computer Science, LSU
- Numerical Methods for SABR models (Computational Finance)  
Numerically reconstruct volatility using the full SABR multi-asset model outlined in "From SABR to Geodesics" by Professor Avellaneda, New York University

### Teaching Duties :

- Assisted Math 7311 Analysis I (Real Analysis : Graduate Course) in Fall 2003, 2004, 2005, and 2006.
- Taught Math 2090 - Elementary Differential Equations and Linear Algebra in Spring 2007.
- Taught Math 1550 - Calculus I in Spring 2004, 2005, and 2006.  
Overall students' evaluation score: 4.56, 4.49, 4.15/5.00 (Dept. Avg : 4.33-4.36/5.00)
- Advised Graduate students
  - Suman Gupta (Department of Computer Science) with Professor Park.
  - Prasad Kalghatgi (Department of Mechanical Engineering) in Cactus CFD Toolkit Group.
- Advised graduate students in analysis exam preparation meetings (Winter 2003).

09/02 - 07/03 **Visiting Assistant Professor**, Mathematical Sciences Department,  
Worcester Polytechnic Institute (WPI)

### Teaching Duties :

- Graduate Course Taught
  - MA 512 - Numerical Differential Equations (Spring 2003)
- Undergraduate Courses Taught
  - MA1022 (Calculus II) (E-term, 2003)
  - MA1024 (Calculus IV) (D-term, 2003) (2 courses)
  - MA3257 / CS4032 - Numerical Methods I. (B-term, 2002)
  - MA1023 (Calculus III) (A-term, 2002)
    - \* Overall undergraduate students' evaluation (except MA1022) : 89 %
    - \* Overall Calculus students' evaluation (except MA1022) : 94 %

05/01 - 08/02 **Postdoctoral Fellow**, Mathematical Sciences Department, WPI

- Joint work for Pool Fire Simulation with CRSim (Combustion and Reaction Simulations) group in C-SAFE (Center for the Simulation of Accidental Fires and Explosions) of the University of Utah.

C-SAFE was created by the University of Utah as an alliance with the DOE (Department of Energy) ASCI (Accelerated Strategic Computing Initiative) to provide the numerical simulation of accidental fires and explosions.

- Built Parallel Multigrid and Additive Schwarz C++ code to increase the scalability of the Arches component of CCA (the Common Computing Architecture).

08/97 - 05/01 Research Assistant, Courant Institute of Mathematical Sciences,  
New York University (NYU)

- Research in numerical algorithms, mainly Overlapping Schwarz Algorithms using Discontinuous Iterates:
  - 1) Developed algorithms, and tested Two Level Methods and preconditioners
  - 2) Constructed the basic concepts and notations.
  - 3) Created a convergence theory based on Lagrange Multipliers.

08/97 - 01/01 Teaching Assistant, Courant Institute of Mathematical Sciences, NYU

- Lectured on Discrete Mathematics.
- Taught Calculus recitation sessions.

01/98 - 08/98 Computer Consultant, Courant Institute of Mathematical Sciences, NYU

- In charge of advising and counseling graduate students in their academic course works, projects and research programming.

03/93 - 08/95 Teaching Assistant, Seoul National University

### **Funding Participated**

- NSF (National Science Foundation) IGERT (Integrated Graduate Education, Research and Training) on CFD (Computational Fluid Dynamics) as Participant : **AWARDED**  
Principal Investigator: Professor Sumanta Acharya, the Department of Mechanical Engineering at LSU, Website: <http://www.cct.lsu.edu/IGERT/Faculty.htm>
- Preparing a joint proposal with Dr. Seung-Jong Park, Dept. of Computer Science, LSU.
- Preparing a joint proposal with Dr. Matthew Anderson, Dept. of Physics, LSU

## **Awards**

01/98 - 08/00 Teaching and Research Assistantship, Courant Institute

03/93 - 08/95 Teaching Assistantship, Seoul National University.

## **Research interests**

- Finite Element Methods; Numerical Partial Differential Equations
- Numerical Linear Algebra and its Applications
- Domain Decomposition Methods; Parallel Computation
- Computational Fluid Dynamics
- Space-Time Finite Element Methods
- Numerical Methods for Stochastic Differential Equations
- Numerical Methods for SABR Models (Computational Finance)
- Numerical Methods for Fluid Models of Networks

## **Computational Skills**

- Languages : Fortran, C++, C, PASCAL, COBOL, ADA and LISP
- Program packages: MATLAB, PETSc, MPI, DB (DataBase) and others
- Tools and environments: Exodus, Cubit, EMACS, HTML, Xfig, LaTeX, Word, UNIX,
- Experienced with and knowledge on most advanced super computers

## **Public Service**

- A member of the committee of Louisiana Chapter of The Korean-American Scientist and Engineers Association (KSEA, [www.ksea.org](http://www.ksea.org)) for the National Mathematics Competition (NMC) held on April 17, 2004.

## **Publications**

- “Overlapping Schwarz Algorithms using Discontinuous Iterates for Poisson’s Equation”, Jung-Han Kimn, Ph.D. thesis, Technical Report TR2001-817, Department of Computer Science, Courant Institute, May 2001.
- “A Convergence Theory for An Overlapping Schwarz Algorithm using Discontinuous Iterates”, Jung-Han Kimn, Numerische Mathematik, 100:117-139, 2005.

- “OBDD: Overlapping Balancing Domain Decomposition Methods and Generalizations to the Helmholtz Equation”, Jung-Han Kimn and Marcus Sarkis, In Olof B. Widlund and David E. Keyes, editors, Domain Decomposition Methods in Science and Engineering XVI, volume 55 of Lecture Notes in Computational Science and Engineering, Pages 317-324, Springer-Verlag, 2006.
- “Numerical Implementation of Overlapping Balancing Domain Decomposition Methods on Unstructured Meshes”, Jung-Han Kimn and Blaise Bourdin, In Olof B. Widlund and David E. Keyes, editors, Domain Decomposition Methods in Science and Engineering XVI, volume 55 of Lecture Notes in Computational Science and Engineering, Pages 309-315, Springer-Verlag, 2006.
- “Restricted Overlapping Balancing Domain Decomposition Methods and Restricted Coarse Problem for the Helmholtz Equation”, Jung-Han Kimn and Marcus Sarkis, Computer Methods in Applied Mechanics and Engineering, 196 (2007), 1507-1514.
- “A Numerical Approach to Space-Time Finite Element Methods for the Wave Equation”, Matthew Anderson and Jung-Han Kimn, Submitted to Journal of Computational Physics, 2006.
- “Parallel Implementation of Overlapping Balancing Domain Decomposition Methods on Unstructured Meshes” , Jung-Han Kimn and Blaise Bourdin, In preparation.
- “Theoretical Analysis Theory of Overlapping Balancing Domain Decomposition Methods for Elliptic Problems”, Jung-Han Kimn and Marcus Sarkis, In preparation.
- “Time-Adaptive Numerical Simulation for High Speed Networks” , Suman Gupta, Jung-Han Kimn and Seung-Jong Park, In preparation.
- “Basket Implied Volatility from Geodesics”, Matthew Anderson and Jung-Han Kimn, In preparation.

### Journal Referee

- Applied Numerical Mathematics (APNUM): two papers (2005)
- Journal of Mathematical Analysis and Applications (2006)
- Numerical Algorithms (2006)
- Hydrogeology Journal, Springer (2007)

### Selected Presentations

- “Parallel Implementation of Domain Decomposition Methods” Applied Analysis Seminar, Louisiana State University, November 20, 2006
- “Domain Decomposition Methods for Partial Differential Equations” Invited Talk, Rochester Institute of Technology, June 13, 2006

- “An additive Schwarz parallel approach to space-time finite elements for hyperbolic equations” (Coauthor) With Matthew Anderson in 10th Copper Mountain Conference on Iterative Methods, April 2-7, 2006, Copper Mountain, Colorado
- “Domain Decomposition Methods” Invited Talk, University of Connecticut, February 7, 2006
- “An Implementation of An Overlapping Balancing Domain Decomposition Method for Large Scale Unstructured Meshes” (Speaker) with Blaise Bourdin , July 11-15, 2005, SIAM (Society for Industrial and Applied Mathematics) 2005 Annual Meeting, New Orleans, Louisiana
- “Implementation of an Overlapping Balancing Domain Decomposition Method for Elliptic PDEs on Unstructured Meshes” (Speaker) with Blaise Bourdin in 12th Copper Mountain Conference on Multigrid Methods, April 3-8, 2005, Copper Mountain, Colorado
- “ Overlapping Balancing Domain Decomposition Method for Unstructured Meshes ” (Speaker) with Blaise Bourdin in Spring 2005 Finite Element Rodeo, March 4-5, Dallas, Texas.
- “Robin Interface Conditions for An Overlapping Schwarz Algorithm” In a minisymposium “Optimized Schwarz methods”, January 11-15, 2005, 16th International Conference on Domain Decomposition Methods, New York City
- “An Overlapping Balancing Domain Decomposition Method for Elliptic PDEs” (Speaker) with Blaise Bourdin. In a minisymposium “Schwarz Preconditioners”, January 11-15, 2005, 16th International Conference on Domain Decomposition Methods, New York City
- “Restricted Balancing Domain Decomposition and Restricted Coarse Problems for the Helmholtz Problem” (Coauthor) with Marcus Sarkis in a minisymposium “Schwarz Preconditioners”, January 11-15, 2005, 16th International Conference on Domain Decomposition Methods, New York City
- “The Restricted Overlapping Balancing Domain Decomposition Method (ROBDD)” (Coauthor) with Marcus Sarkis, July 12-16, 2004, 2004 SIAM Annual meeting, Portland Oregon
- “Restricted Overlapping Balancing Domain Decomposition and Restricted Coarse Problems” (Coauthor) with Marcus Sarkis, June 14-19, 2004, Modern Computational Methods in Applied Mathematics (MCM) 2004, Poland
- “Overlapping Domain Decomposition Methods” Applied Analysis Seminar, Louisiana State University, September 8, 2003
- “Overlapping Balancing Domain Decomposition” Sixth IMACS International Symposium on Iterative Methods in Scientific Computing, University of Colorado at Denver, March 27-30, 2003

- “Domain Decomposition Methods and a Convergence Theory” Invited Talk, Northern Illinois University, February 28, 2003
- “Domain Decomposition Methods ” Invited Talk, Case Western Reserve University, February 4, 2003
- “A Convergence Theory for Discontinuous Overlapping Schwarz Method ” Finite Element Circus, Fall 2002, Penn State University, October 25-26, 2002.
- “A Convergence Theory based on Lagrange Multipliers for the Discontinuous Overlapping Schwarz Method”, Applied Math and Analysis Workshop, Brown University, May 11-12, 2002
- “Additive Schwarz Methods and Multilevel Methods” Fire Spread Team (CRSim), the University of Utah, April 26, 2002.
- “Overlapping Schwarz Algorithms using Discontinuous Iterates” WPI Applied / Computational Mathematics Seminars, November 26, 2001
- “Large Scale Fire Simulations on Parallel Processors” presentation with Wing K. Yee, Phillip J. Smith, Rajesh Rawat, and Divya Ramachandran from University of Utah; Homer F Walker, and Julia S. Mullen from Worcester Polytechnic Institute Site Visit for C-SAFE (Center for the Simulation of Accidental Fires and Explosions), the University of Utah, September 6-7, 2001.

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