

## Aditya Velivelli

Virtual Reality Applications Center  
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### Research Interests:

Computational fluid mechanics and heat transfer, parallel computing, molecular simulation, and interactive visualization using virtual reality systems

### Education:

Doctor of Philosophy (PhD) Expected July 2005

Mechanical Engineering, Iowa State University

Thesis Title: "*Computational Fluid Dynamics for Interactive Design and Optimization*"

(Synopsis given towards the end)

Master of Science (MS) August 2001

Mechanical Engineering, University of Missouri-Rolla

Master's Thesis: "*Virtual Sculpting: Interactive Solid Modeling in a Virtual Environment*"

Bachelor of Engineering (BE) June 1999

Mechanical Engineering, Osmania University, India

### Research Experience:

Graduate Research Assistant Sept 2001-Present

Virtual Reality Applications Center, Iowa State University

Developed cache-optimization and parallel computing techniques for computational models handling fluid flows. Coupled different numerical methods using domain decomposition techniques. Performance testing of virtual reality systems for visualizing fluid flows.

Graduate Research Assistant Aug 1999-Aug 2001

University of Missouri-Rolla

Developed virtual reality based solid modeling system. Virtual reality environment included stereo viewing, haptics (force-feedback) interface, and six degrees of freedom tracker. Used swept volume technique for solid modeling of machining tools used in CNC milling.

Project Trainee Nov 98-May 99

Bharat Heavy Electricals Limited (BHEL), India

Software development for automating the generation of CNC part programs as well as graphics display for different types of impellers. Operated the 5-axis CNC machine on which the impellers were machined.

### Teaching Experience:

Instructor, Heat Transfer Lab Sept-Dec 2001

Mechanical Engineering Dept., Iowa State University

Taught the lab for ME 436, Heat Transfer, a senior level Mechanical Engineering course. Responsible for all aspects of the lab including setting up experiments, giving lectures, exams, and grading and assignment of grades. Course evaluations are available upon request.

Responsible for grading assignments and answering questions regarding homework problems.

### **Refereed Publications:**

Aditya Velivelli, and Kenneth M. Bryden. "Parallel performance and accuracy of lattice Boltzmann and implicit finite difference methods for solving the unsteady two-dimensional Burger's equation." To be published in *Physica A (Proceedings of DSFD 2004)*.

Aditya Velivelli, and Kenneth M. Bryden. "A cache-efficient implementation of the lattice Boltzmann method for the two-dimensional diffusion equation." *Concurrency and Computation: Practice and Experience*. Vol. 16, Dec 2004, pp. 1415-1432.

Aditya Velivelli, and Kenneth M. Bryden. "An improved lattice Boltzmann method for steady fluid flows." *Proceedings of 2004 ASME International Mechanical Engineering Congress (IMECE)*, Anaheim, CA, November 2004.

Aditya Velivelli, and Kenneth M. Bryden. "Parallel performance of lattice Boltzmann and implicit finite difference approaches to the approximation of the two-dimensional diffusion equation." *Proceedings of 2003 ASME International Mechanical Engineering Congress (IMECE)*, Anaheim, CA, November 2003.

Ming Leu, Aditya Velivelli, and Xiaobo Peng. "Creating freeform model by carving virtual workpiece with haptic interface." *Proceedings of 2002 ASME International Mechanical Engineering Congress (IMECE)*, New Orleans, LA, November 2002.

### **Research Activities/Presentations:**

Aditya Velivelli, and Kenneth M. Bryden. "Coupling the lattice Boltzmann method and the ADI method for numerical solution of steady fluid flow problems." To be submitted for publication.

Aditya Velivelli, and Kenneth M. Bryden. "Parallel performance of lattice Boltzmann method for the 2-D steady state Burger's equation" presented at the 11<sup>th</sup> SIAM Conference on Parallel Processing for Scientific Computing, San Francisco, February 2004.

### **Computing Skills:**

Programming Languages:	C, C++, Fortran
Parallel Programming:	MPI, OpenMP
Application Packages:	Fluent, Pro/engineer, Catia
Graphics/VR Toolkits:	VRjuggler, OpenGL

### **Graduate Courses:**

Computational fluid dynamics	Parallel computing
Statistical mechanics	Advanced combustion
Computer graphics	Numerical analysis

### **Professional/Other Activities:**

Conference referee, ASME International Mechanical Engineering Congress (IMECE), 2004

President, International Students Club at University of Missouri-Rolla, 2000-2001

Project coordinator, Sankalp, an Iowa State student organization that supports literacy projects in India, 2003-2004

## Thesis Topic

### **Computational Fluid Dynamics for Interactive Engineering Design and Optimization**

My research comes out of the need to develop faster simulation tools for problems involving multiple space and time scales. This will make it possible to conduct interactive engineering design or optimization of many practical systems. Currently, I am developing new algorithms for computational fluid dynamics that obtain results with significantly less computation time than traditional algorithms. These efforts include coupling different numerical methods (lattice Boltzmann and traditional finite difference methods) using domain decomposition, and developing cache optimization and parallel computing techniques. The lattice Boltzmann method is based on a minimal form of the kinetic equations (from gas kinetic theory) that can recover hydrodynamic behavior. It is well suited for cache optimization and parallel computing, because the floating-point operations in this method involve local data.

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