

News & Notes

Spring 2010 ♦ Issue Forty-five

CompSci @ Carolina



Dear Friends,

It has been a particularly unusual winter weather-wise in Chapel Hill, with more snow than we've seen in quite a while, though still not a lot by most standards. Spring is nearly here, however, and soon we will be graduating another class of graduate and undergraduate students and sending them on their way into the world. Our collective hope is that we've prepared them well for the world they will enter.

This year, UNC is celebrating 50 years of computing at Carolina. Sponsored jointly by UNC's Information Technology Services, the Department of Computer Science and the School of Information and Library Science, the celebration honors the dedication of UNC's Computation Center on March 30, 1960. Fittingly, Fred Brooks is giving the keynote address at the event.

Congratulations to Dinesh Manocha on being named an ACM Fellow. It is a well-deserved honor.

Congratulations also to Liangjun Zhang, who graduated in 2009 and was, incidentally, advised by Dinesh, on receiving UNC's Linda Dykstra Distinguished Dissertation Award in Mathematics, Physical Sciences and Engineering for 2010. The award recognizes one dissertation in each of four categories each year as being the best at UNC. You can read more about Zhang on page 4.

Finally, I'd like to thank those of you who have supported the department financially in the past and encourage all of you who can to do so in the future. Your donations make a real difference to the department, especially in these tough economic times. So, thank you for donating!

AVATARS AND BATHYSPHERES

Imagine you wanted to attend SIGGRAPH. Your current options would be to either go there physically or to not go and, perhaps, watch some video of some of the proceedings online. It wouldn't be very exciting for someone who couldn't attend in person.

However, what if you weren't able to attend in person but you could attend SIGGRAPH virtually, using a physical avatar that could move around and interact with others at the conference?

If Research Associate Professor Greg Welch (Ph.D. 1996) has his way, that will be an option for you in the future. Welch, along with Professor Henry Fuchs, is leading the development of dynamic physical avatars that mimic the motion and appearance of a real person.

They have developed a head-only proof-of-concept avatar system comprised of a camera, a tracking system, a digital projector, and a life-sized Styrofoam head mounted on a pan-tilt unit.

In order to make the avatar come to life, they capture imagery of a moving, talking user (a real person), and use Shader Lamps, a way of "painting" white physical objects with digital light, and other new methods to retarget the shape, motion, and dynamic appearance to the animatronic avatar. This approach inherently provides a sense of physical shape, naturally accommodating all nearby observers without the need for head worn displays, glasses, or tracking systems.

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Welch and Fuchs, with Peter Lincoln, Andrew Nashel, Adrian Ilie, and Andrei State, presented the work at the 2009 International Symposium on Mixed and Augmented Reality (ISMAR '09). This included a paper (presented by Peter Lincoln) and a demonstration of the prototype system using a professional comedian as the inhabitant. Then in February 2010, computer science graduate student Rick Skarbez became the face of the avatar for the CHAT Digital Arts and Humanities Festival. Skarbez, who currently performs with DSI Comedy in Carrboro in his free time, performed some improv comedy as "Dr. Rick" for attendees at the festival.

Animatronic Shader Lamps Avatar wasn't the only exhibit Welch had a hand in at the CHAT Festival. He also teamed up with Associate Professor Francesca Talenti in the Department of Communications Studies, and some staff and students in computer science and communications studies, to create "*The Bathysphere*: Motion Capture as Art."

The Bathysphere was both an underwater symphony and an interactive game. Participants got the feeling of being in an underwater world, complete with an octopus, a manta ray and a school of fish. The actions of the sea creatures were controlled by the participants, using a ball for the octopus, a fishing rod for the school of fish and an umbrella for the manta ray. Each of the sea creatures also adds its own melody to the experience.

In *The Bathysphere* project, the researchers' aim was to translate movement generated by an object (the ball, for instance), rather than that of a human in a motion capture suit. Through the captured data, they were able to generate non-human characters. This project was a chance to use a motion capture system purely for artistic and scholarly computer science exploration. While *The Bathysphere* had undoubtedly whimsical elements, it also had severe technological requirements, ranging from running the motion capture system to networking 6 computers and 4 projectors, and implementing code for communication between all the software and the hardware used.

Right: The "Dr. Rick" avatar, played by graduate student Rick Skarbez during the CHAT Festival. Participants interacted with the "Dr. Rick" avatar the way they would have a real person, and "Dr. Rick" was able to look at and speak to attendees.



Below: Behind the scenes of the Animatronic Shader Lamps Avatar demonstration at the CHAT Festival - graduate student Rick Skarbez suited up with a head-mounted tracker for the demo while graduate student Peter Lincoln took care of the technical side of things.



Above: An audience member controls the manta ray using an umbrella fitted with motion capture technology in *The Bathysphere*.

DEPARTMENT NEWS

WELCOME New Staff

The following staff members joined the Computational Systems Biology group in fall 2009:

Sandy Hall (B.S.M.Sci. 2001) is an application programmer

Todd Taft (B.S.M.Sci. 1997) is a systems administrator

Alex Vu is a database programmer

Visiting Researchers and Faculty

Quentin Avril is a visiting scholar working with Ming Lin.

Aaron Block (Ph.D. 2008) is a visiting lecturer for Spring 2010 teaching COMP 110: Introduction to Programming.

Pierre Georgel is a postdoctoral research associate working with Jan-Michael Frahm on real-time scene reconstruction on a single computer.

Muhammed Miah is a visiting research scholar working with the Computational Systems Biology group.

Richard Steffen is a visiting postdoctoral researcher working with Jan-Michael Frahm. He is funded by the German Science Foundation.

THANKS AND FAREWELL

Graham Gash retired in December 2009 with 25 years of service to the University.

CONGRATULATIONS Faculty and Staff

Jan Prins received an IBM Faculty Award titled "Dynamic Load Balancing Techniques for Extreme-Scale Business Applications" in August 2009.

Graduate Students

Cong Liu received a best student paper award at Real-Time Systems Symposium in December 2009 for the paper titled, "Task Scheduling with Self-Suspensions in Soft Real-Time Multiprocessor Systems," co-authored with Jim Anderson. RTSS is the top conference on real-time systems.

Zhimin Ren was awarded a UNC Of-

fice for Undergraduate Research graduate mentor award for her work with undergraduate Maggie Zhou.

Vishal Verma received the best student paper award at the ACM SIGSPATIAL 2009 conference for the paper titled, "Reducing the memory required to find a geodesic shortest path on a large mesh," co-authored with Jack Snoeyink. The conference was held in Seattle, Wash., Nov. 4-6, 2009.

Undergraduate Students

Eric Gregory Daniel and **Wing-Soon Wilson Lian** were initiated into the Alpha of North Carolina chapter of Phi Beta Kappa in November 2009.

UPCOMING WORKSHOPS

Ron Alterovitz is co-organizing a workshop on "Medical Cyber-Physical Systems" that will be held at the IEEE International Conference on Robotics and Automation (ICRA) in May 2010 in Anchorage, Alaska. The goal of this workshop is to expose and explore current research issues in advanced medical systems in which computation is intimately coupled to physical systems and humans. The integration of computation with physical systems has the potential to improve speed, precision, and dexterity during robot-assisted surgery as well as enable new medical procedures. This full-day workshop will bring together researchers and practitioners to discuss new and emerging algorithms, devices, sensors, and user interfaces for medical cyber-physical systems, including robotic surgical assistants and other medical robotic systems.

RECENT SPONSORED RESEARCH AWARDS

2009 IRAD: Realtime Virtual Tactical Operations (RTVO). PI: Jan-Michael Frahm. Lockheed Martin.

3D Imaging and Mapping Technologies for Autonomous Robotic Exploration. PI: Jan-Michael Frahm. Texas A&M/National Aeronautics and Space Administration.

3D Scanning for Biometric Identification and Verification. PI: Anselmo Lastra. RTI International/Department of Homeland Security

ABI: Exon Splice Pattern Characterization of the Whole mRNA Transcriptome. PI: Jan Prins. University of Kentucky/National Science Foundation.

Advanced security policy enforcement for tomorrow's reconfigurable systems. PI: Michael Reiter. National Science Foundation.

Advanced security policy enforcement for tomorrow's reconfigurable systems. PI: Michael Reiter. Office of Naval Research.

A Real-Time Linux for Multicore Platforms. PIs: James Anderson and Sanjoy Baruah. US Army Research Office.

Collaborative Research: CDI-Type II - Revolutionary Advances in Modeling Transport Phenomena in Porous Medium Systems. Co-PI: Jan Prins. National Science Foundation.

Development of a Volume Calculation Algorithm for Implicit Surface Geometric Representations. PI: Jack Snoeyink. Bettis Atomic Power Laboratory.

FRG: Advanced Algorithms and Software for Problems in Computational Bio-Fluid Dynamics. Co-PI: Jan Prins. National Science Foundation.

Respiratory Motion-Reduced Cone-Beam CT Guidance of Radiotherapy in Lung & Liver. PI: Stephen Pizer. Sloan-Kettering Institute for Cancer Researcher/National Institutes of Health.

Scalable Statistical Visualization Components. PI: Russell Taylor. Sandia National Labs/US Department of Energy.

Simulation & Training Technologies for Counter-terrorism, Evacuation Planning and Disaster Response. PI: Ming Lin. Co-PI: Dinesh Manocha. RTI International/Department of Homeland Security.

Supporting Mixed-Criticality Avionics Workloads on Multicore Platforms. PIs: James Anderson and Sanjoy Baruah. Northrup Grummon.

IN MEMORIAM

Betsy Farrington, housekeeper for the department in New West Hall, died on 28 January 2010 in Chapel Hill. Of Farrington, Lib Moore Jones writes, "Her faithfulness in her work and love for us all - faculty, staff and graduate students - was precious." Farrington retired from the University at the age of 62.

MANOCHA NAMED ACM FELLOW



Professor Dinesh Manocha was recently named a fellow of the Association for Computing Machinery (ACM) for contributions to geometric computing and applications to computer graphics, robotics and Graphics Processing Unit computing.

Manocha, the Phi Delta Theta/Matthew Mason Distinguished Professor of Computer Science, is an expert in computer graphics and geometric modeling. His research on mathematical foundations and applications has been used in scientific computations, robotics, 3-D computer graphics and virtual reality by the scientific community, the computer industry and the entertainment world.

ACM named 47 new fellows for their contributions to computing technology that have created a broad range of innovations for industry, commerce, entertainment and education. The fellows were chosen from the world's leading industries, universities and research labs. They will be honored at the annual ACM Awards Banquet on June 26, 2010.

Manocha, who joined the department's faculty in 1992, earned a bachelor's degree from the Indian Institute of Technology, Delhi, in 1987, and master of science and doctorate degrees from the University of California at Berkeley in 1990 and 1992, respectively.

ACM is the world's largest educational and scientific computing society.

ZHANG RECEIVES DISTINGUISHED DISSERTATION AWARD



Liangjun Zhang (Ph.D. 2009) was the recipient of UNC's 2010 Linda Dykstra Distinguished Dissertation Award in Mathematics, Physical Sciences and Engineering for his dissertation titled "Efficient Motion Planning using Generalized Penetration Depth Computation" under his advisor Dinesh Manocha. Recipients are nominated for the award, which recognizes the best dissertations at UNC-Chapel Hill in each of four areas: Mathematics, Physical Sciences and Engineering; Social Sciences; Biological and Life Sciences; and Humanities and Fine Arts.

Zhang's dissertation makes novel contributions to geometric computing and robot motion planning, and presents new techniques to formulate and compute a measure of penetration among intersecting objects and

use it for robot motion planning. The problem of computing a collision-free path for a robot in the physical or virtual world is fundamental in the design of autonomous robots (e.g. Roomba vacuum cleaners, automatic lawn mower or a robotic car). His dissertation presents the very first set of practical and complete motion planning algorithms for low degrees of freedom robots. The notion of completeness means that his algorithms can terminate in finite time if a path is found or there is indeed no such path. On the other hand, prior sampling-based motion planning algorithms could not check for path non-existence and may go into an infinite loop. This was a major unsolved problem in robot motion planning and his dissertation presents the first practical algorithm. Zhang also presents an efficient sampling-based motion planning algorithm for rigid robots based on retraction computation. He demonstrates that this planning algorithm can be useful for part disassembly and maintainability test problems which frequently arise in

virtual prototyping and computer-aided design (CAD).

Zhang's dissertation and subsequent work has resulted in 17 publications in the top conferences and journals in robotics, geometric computing and computer-aided design, including one best paper award. Currently, Zhang is a CRA/NSF/CCC Computing Innovation Postdoctoral Fellow in the computer science department at Stanford University. This fellowship was highly competitive, with 60 recipients among 526 applicants from recent Ph.D. graduates in the U.S. Under his mentor Professor Jean-Claude Latombe, he is mainly working on modeling and conformational sampling of folded proteins in order to analyze their structural flexibility.

Zhang is the second recipient of the Linda Dykstra Distinguished Dissertation Award from the department. Brad Davis (Ph.D. 2008) received the 2009 award for his dissertation titled "Medical Image Analysis via Fréchet Means of Diffeomorphisms," under his advisor Sarang Joshi.

SECURELY SEARCHING - MATT CUTTS (M.S. 1998)

After four years of working toward a Ph.D. in Chapel Hill, in 1999 Matt Cutts was at a crossroads. He had gotten his Master's degree the year before, but the focus of his Ph.D. topic had shifted, which made him idly wonder what else he might be doing. So he emailed Google.

“When I was researching my Ph.D. topic, I used Google and I could see they had far and away the best search technology,” explains Cutts. “I dropped them an email asking about salary and they replied that they didn’t discuss salary with anyone who wasn’t a candidate. Then a few days later—they must have done a search on me—they wrote and asked if I’d like to be a candidate.” He did two phone screens and then flew out to interview in Mountain View.

Around Thanksgiving 1999, Google offered Cutts a job, but he was several months away from getting married and thought about finishing his Ph.D. “I have to credit [Professor] Gary Bishop for helping me decide. He said, ‘You might find that industry experience will be good for you. It might work out great, and if not, you can come back and finish.’” Everything happened quickly after that—Cutts wrapped up his life in Chapel Hill, eloped with his fiancée, took a quick honeymoon cruise, and drove with her to California in January 2000 to begin as a Google software engineer.

He started on his first major project when his manager said to him, “We have a customer who wants a family-friendly version of Google.” After two to three months of writing code and testing—and learning a lot of new words—Cutts produced SafeSearch. “Our mental model was a mom searching with her Cub Scout son—would she find a given page offensive?” Cutts says that massively filtering for a word often used in an offensive way risks

losing useful sites (e.g., filtering universally for “breast” would leave breast-cancer sites out of a search). Rather, Google’s approach was to select out the bad pages individually. SafeSearch continuously processed Google’s index of the web, evaluating new pages and scoring them individually.

Afterward, Cutts was assigned to the ad group, five engineers who were writing code for another kind of search engine. “When you do a Google search, we use that query to search a pool of ads to bring up ads that are relevant to your search.” So when you search for “Sicily,” you’ll see a few ads for companies that offer travel there, instead of randomly placed ads about weight loss.

Cutts likes his work at Google, a company whose ethos he says is maturing from its hot-shot startup days into one that fosters creativity, while encouraging a balance of work and life. “It’s a great place to work—a ton of fun. There are several thousand engineers, and you never know exactly what you’ll be working on when you come into the office in the morning.” Projects are al-

ways bubbling up at Google, and many of the best ideas come from the software engineers. “We have a twenty-percent time policy,” explains Cutts. “Engineers can work on their own projects for twenty percent of their work time. Great ideas come from our engineers, and we’re encouraged to talk and collaborate with others.”

For the last several years, Cutts has worked in the Search Quality group as head of the webspam team. “If you type in the name of a medication, you should probably get the official site, but there are people who try to get ranked higher in the search list and perhaps fool you into selecting their page. My team writes algorithms to detect and counteract when people try to cheat.” It would seem to be a Sisyphean task, but Cutts says, “We’ve made a lot of progress. It’s been rewarding.”

Ten years after sending an email query to Google, Cutts is a principal engineer there, and he marvels at how it worked out. “I had no idea back then that joining Google was such a great choice, but I’m grateful that I landed in the right spot.”



Matt Cutts speaks at Web 2.0 Expo San Francisco in 2008. Photo courtesy James Duncan Davidson.

ALUMNI NEWS

M.S. and Ph.D. Alumni

David F. McAllister (Ph.D. 1972), NCSU Professor Emeritus, presented a paper on Methods For Computing Color Anaglyphs at the Electronic Imaging Conference 2010 in San Jose, Calif., in January. The paper will appear in the proceedings of Stereo Applications and Displays XXI. David is enjoying his retirement and doesn't miss going to meetings. He continues to direct graduate students. He avoids workmen in his house while they install a new furnace, new flooring, new lighting, new plumbing, new roof, new paint, and other extensive renovations. (david@cmonline.com)

Doug Walker (M.S. 1985) recently started a new job in the Advanced Computing Lab at SAS Institute, where he is working on distributed computing problems. (doug@walkerfamily.name)

After 10 years at Microsoft, **Sailesh Chutani** (M.S. 1988) started a medical device company, Mobisante, Inc., in December 2009, to make Ultrasound imaging more affordable and convenient. (schutani@pacbell.net)

Penny Rheingans (Ph.D. 1993) was recently promoted to Professor of Computer Science at the University of Maryland, Baltimore County. In addition to her faculty role, she has also assumed the position of Director of the UMBC Center for Women and Information Technology (CWIT), dedicated to increasing the representation of women in engineering and information technology. (rheingan@cs.umbc.edu)

Amitabh Varshney (Ph.D. 1994) was recently elected as an IEEE Fellow. He is currently a professor of computer science at the University of Maryland at College Park. (varshney@cs.umd.edu)

David Luebke (Ph.D. 1998) was officially promoted to "Director of Research" at NVIDIA Corporation in December 2009. On the personal front, he and his wife have two boys: Owen (6) and Edwin (3) and continue to enjoy life in Charlottesville, Va. (dave@luebke.us)

Chris Dwyer (Ph.D. 2003) was awarded a young investigator award from the Army Research Office (in 2008) for which he was given the Presidential Early Career Award for Scientists and Engineers in January 2010. The award is the highest bestowed by the U.S. government upon scientists and engineers in the early stages of their independent research careers. Winners of the award receive up to a five-year research grant to further their study in support of critical government missions. Chris is an assistant professor in the departments of electrical and computer engineering and computer science at Duke. (cdwyer@ece.duke.edu)

Bill Baxter (Ph.D. 2004) left Japan and OLM Digital in March 2009 and joined **Naga Govindaraju's** (Ph.D. 2004) team in Microsoft. That team is part of what is now called the eXtreme Computing Group (XCG), inside of Microsoft Research. (wbaxter@gmail.com)

Tom Hudson (Ph.D. 2004) left academia in 2007 to move back to the Triangle and has spent the years since in the game industry, originally in middleware, now in medical and military training applications. (hudson@alumni.unc.edu)

Undergraduate Alumni

Sam Brodtkin (B.S.M.Sci. 1997) recently gave a talk at the Devovx Conference in Antwerp entitled: Google App Engine for Java - A Real Live Voyage to The Cloud with an accompanying open source application online at <http://swagswap.org>. (sam@brodtkin.com)

Former Faculty and Staff

Peter Calingaert, professor emeritus, continues to lead international trips for the Sierra Club, most recently to northern India in November 2009. The next trip is planned to western Turkey in April 2010. (pc@cs.unc.edu)

Liyun Yu, who was a postdoctoral fellow in 1994-1996 working with Steve Pizer, was named an ACM Senior Member in 2009. (liyuny@med.unc.edu)

ALUMNI PUBLICATIONS

Bill Baxter (Ph.D. 2004, wbaxter@gmail.com):

Baxter, W. and N. Govindaraju, "Simple Data-Driven Modeling of Brushes," *Proc. of the Symposium on Interactive 3D Graphics and Games*, Feb. 2010.

Mark Hutchinson (B.S.M.Sci. 1981, aikimark@aol.com):

Passing lists and complex data through a parameter, *Experts-Exchange.com*, <http://www.experts-exchange.com/viewArticle.jsp?aid=1679>

FAMILY MATTERS

Peter Calingaert, professor emeritus, welcomed grandson Adam in June 2009, raising the number of his grandchildren to five. (pc@cs.unc.edu)

Liangjun Zhang (Ph.D. 2009) and his wife, Feiqi Su, welcomed Stanley Su on 24 September 2009, in Palo Alto, Calif. (liangjun.zhang@gmail.com)

Yoni Fridman (Ph.D. 2004) and his wife, Adelia, welcomed Leah Grace on 22 October 2009, in Divide, Co. She joins big sister, Sarah Ann (1 1/2). (yonifridman@gmail.com)

Tom Hudson (Ph.D. 2004) and his wife, Challe, welcomed their third son, Weyland, on 31 January 2010, in Durham, N.C. Weyland joins older siblings Garrett (8) and Tallis (5). (hudson@alumni.unc.edu)

Bill Baxter (Ph.D. 2004) and his wife, Eriko, welcomed Luna Yuki-ka on 1 February 2010, in Kirkland, Wa. Luna joins big brother Billy IV (5), who Bill reports is absolutely the perfect gentleman with his little sister. (wbaxter@gmail.com)

Graduate student **Cory Quammen** and his wife, Sandy, welcomed Linnea Marit on 15 February 2010, in Durham, N.C. (cquammen@cs.unc.edu)

RECENT PUBLICATIONS

- Bandyopadhyay, D., J. Huan, J. Prins, J. Snoeyink, W. Wang and A. Tropsha. "Identification of Family-Specific Residue Packing Motifs and their use for Structure-Based Protein Function Prediction: I. Method Development," *Journal of Computer-Aided Molecular Design*, Nov. 2009, 23(11):773-784.
- Chandak, A., L. Antani, M. Taylor and D. Manocha. "FastV: From-point Visibility Culling on Complex Models," *Eurographics Symposium on Rendering*, June-July 2009, 28(4):1237-1246.
- Guy, S. J., J. Chhugani, C. Kim, N. Satish, M. C. Lin, D. Manocha and P. Dubey. "Clear-Path: Highly Parallel Collision Avoidance for Multi-agent Simulation," *ACM SIGGRAPH/Eurographics Symposium on Computer Animation (SCA)*, 2009.
- "High Performance Computing on Cell B.E. Processors," special issue of *Scientific Programming*, Gschwind, M., F. Gustavson, J. Prins (Eds.), IOS Press, 2009, 17(1-2):1-2.
- Hudson, N.E., J.R. Houser, E.T. O'Brien, R.M. Taylor Jr., R. Superfine, S.T. Lord, and M.R. Falvo. "Stiffening of Individual Fibrin Fibers Equitably Distributes Strain and Strengthens Networks," *Biophysical Journal*, May 2010. To appear.
- Lauterbach, C., Q. Mo and D. Manocha. "Fast Hard and Soft Shadow Generation on Complex Models Using Selective Ray Tracing," Technical Report: TR09-004, Jan. 2009.
- Lauterbach, C., Q. Mo and D. Manocha. "gProximity: Hierarchical GPU-based Operations for Collision and Distance Queries," *Eurographics*, 2010. To appear.
- Lauterbach, C., Q. Mo and D. Manocha. "Work Distribution Methods on GPUs," Technical Report: TR009-16, 2009.
- Leontyev, H., and J. Anderson. "A Hierarchical Multiprocessor Bandwidth Reservation Scheme with Timing Guarantees," *Real-Time Systems*, special issue on selected papers from the 20th Euromicro Conference on Real-Time Systems, Sept. 2009, 43(1):60-92.
- Leontyev, H., and J. Anderson. "Generalized Tardiness Bounds for Global Multiprocessor Scheduling," *Real-Time Systems*, Mar. 2010, 44(1-3).
- Liu, C., and J. Anderson. "Scheduling Suspendable, Pipelined Tasks with Non-Preemptive Sections in Soft Real-Time Multiprocessor Systems," *Proc. of the 16th IEEE Real-Time and Embedded Technology and Applications Symposium*, Stockholm, Sweden, IEEE Computer Society Press, Apr. 2010. To appear.
- Lyons, L.A., R.J. Webster III and R. Alterovitz. "Planning Active Cannula Configurations Through Tubular Anatomy," *Proc. of the IEEE International Conference on Robotics and Automation (ICRA)*, May 2010. To appear.
- Merrell, P., and D. Manocha. "Constraint-based Model Synthesis," *SIAM/ACM Joint Conference on Geometric and Physical Modeling*, 2009.
- Mills, A., and J. Anderson. "A Stochastic Framework for Multiprocessor Soft Real-Time Scheduling," *Proc. of the 16th IEEE Real-Time and Embedded Technology and Applications Symposium*, Stockholm, Sweden, IEEE Computer Society Press, Apr. 2010. To appear.
- Patil, S., and R. Alterovitz. "Automated Tissue Retraction for Robot-Assisted Surgical Procedures," *Proc. of the IEEE International Conference on Robotics and Automation (ICRA)*, May 2010. To appear.
- Patil, S., J. van den Berg, S. Curtis, M. C. Lin and D. Manocha. "Directing Crowd Simulations Using Navigation Fields," *IEEE Transactions on Visualization and Computer Graphics*, 2010. To appear.
- Sewall, J., D. Wilkie, P. Merrell and M. C. Lin. "Continuum Traffic Simulation," *Eurographics*, 2010, 29(2). To appear.
- Sewall, J., J. van den Berg, M. C. Lin and D. Manocha. "Virtualized Traffic: Reconstructing Traffic Flows from Discrete Spatio-Temporal Data," *IEEE Transactions on Visualization and Computer Graphics* (Special Issue on the Best of), 2010. To appear.
- Snape, J., J. van den Berg, S. J. Guy and D. Manocha. "Independent Navigation of Multiple Mobile Robots with Hybrid Reciprocal Velocity Obstacles," *IEEE/RSSJ International Conference on Intelligent Robots and Systems (IROS)*, 2009.
- Snape, J., S. J. Guy, J. van den Berg, S. Curtis, S. Patil, M. C. Lin and D. Manocha. "Independent Navigation of Multiple Robots and Virtual Agents," Demonstrations, *Proc. of the International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2010. To appear.
- Snape, J., and D. Manocha. "Navigating Multiple Simple-Airplanes in 3D Workspace," *IEEE International Conference on Robotics and Automation (ICRA)*, Anchorage, Alaska, 2010. To appear.
- Tang, M., S. Curtis, S. Yoon and D. Manocha. "ICCD: Interactive Continuous Collision Detection between Deformable Models Using Connectivity-based Culling," *IEEE Transactions on Visualization and Computer Graphics*, July-Aug. 2009, 15(4):544-557.
- Tang, M., D. Manocha and R. Tong. "Fast Continuous Collision Detection Using Deforming Non-Penetration Filters," *ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (i3D 2010)*, 2010. To appear.
- Tang, M., D. Manocha and R. Tong. "MCCD: Multi-Core Collision Detection between Deformable Models," *SIAM/ACM Joint Conference on Geometric and Physical Modeling*, 2009, pp. 355-360.
- Tang, M., D. Manocha and R. Tong. "MCCD: Multi-Core Collision Detection between Deformable Models using Front-Based Decomposition," *Graphical Models*, 2010. To appear.
- Taylor, M., A. Chandak, Z. Ren, C. Lauterbach and D. Manocha. "Fast Edge-diffraction for Sound Propagation in Complex Virtual Environments," *EAA Auralization Symposium*, Espoo, Finland, June 2009.
- Taylor, M., A. Chandak, L. Antani and D. Manocha. "RESound: Interactive Sound Rendering for Dynamic Virtual Environments," *International Conference on Multimedia*, Oct. 2009, pp. 271-280.
- van den Berg, J., J. Snoeyink, M. C. Lin and D. Manocha. "Centralized Path Planning for Multiple Robots: Optimal Decoupling into Sequential Plans," *Robotics: Science and Systems (RSS)*, June 2009.
- van den Berg, J., S. J. Guy, M. C. Lin and D. Manocha. "Reciprocal n-body Collision Avoidance," *International Symposium on Robotics Research (ISRR)*, 2009.
- van den Berg, J., J. Sewall, M.C. Lin and D. Manocha. "Virtualized Traffic: Reconstructing Traffic Flows from Discrete Spatio-Temporal Data," *IEEE Virtual Reality (VR)*, 2009, pp. 183-190.
- Wilkie, D., J. van den Berg and D. Manocha. "Generalized Velocity Obstacles," *IEEE/RSSJ International Conference on Intelligent Robots and Systems (IROS)*, St. Louis, Missouri, Oct. 2009, pp. 5573-5578.
- Zhang, L., J. Pan and D. Manocha. "Motion Planning of Human-like Robots Using Constrained Coordination," *IEEE-RAS International Conference on Humanoid Robots (Humanoids09)*, 2009.

News&Notes

DEPARTMENT OF COMPUTER SCIENCE
COLLEGE OF ARTS & SCIENCES
THE UNIVERSITY OF NORTH CAROLINA
CB# 3175, BROOKS COMPUTER SCIENCE
BUILDING
CHAPEL HILL, NC 27599-3175

EDITOR

KELLI GASKILL
gaskill@cs.unc.edu

GENERAL INFORMATION

VOICE: (919) 962-1700
FAX: (919) 962-1799
E-MAIL: info@cs.unc.edu
WEB: www.cs.unc.edu

ADDRESS CORRECTIONS, SUBMISSIONS,
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BARDEZ FUND STILL GOING STRONG

When Joan Bardez graduated from the Department of Computer Science with a master's degree in 1968, she returned to her home state of California. Some of her final paychecks from the department had failed to reach her before her move, however, and were mailed to her after the fact. Already employed, she returned the money to the department, saying that maybe some other student could benefit from it more than she could. And, thus, the Bardez fund was born.

The Bardez fund helps about 20 graduate students in computer science each year by providing them short-term, no interest loans when they need a little financial cushion due to various circumstances. Tim Quigg, associate chair for administration and finance in computer science, administers the fund, telling students about it at orientation in the fall. To receive the help, students just go to Quigg and ask.

Quigg says that the fund is an example of the caring the department

shows for its people and is consistent with the overall atmosphere. He says the most common time students come to him for help is at the beginning of the semester, particularly in the fall, when there might have been a mix up with paperwork and the student, as a result, doesn't receive a paycheck on time.

Bardez says she is happy that the fund is still around and that her generosity continues to help students. Today Bardez still donates to UNC, because, she says, "To receive an education like that was a tremendous gift. It always felt like the right thing to do to pay it back."

You, too, can donate to the Department of Computer Science at UNC by visiting <https://college.unc.edu/foundation/makeagift> and designating that the gift be directed to the department, or you can simply mail your gift directly to the department at the address on the back of this newsletter.



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