

# RAVISH MEHRA

PhD candidate

Department of Computer Science

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## Research Interests

Computer graphics, acoustics, signal processing, virtual and augmented reality, parallel computing

## Education

<b>PhD candidate in Computer Science</b> , University of North Carolina, Chapel Hill, NC, USA Advisor: Prof. Dinesh Manocha	July 2014 ( <i>expected</i> )
<b>MS in Computer Science</b> , University of North Carolina, Chapel Hill, NC, USA	2009-2011
<b>Bachelor of Technology (BTech) in Computer Science</b> , IIT Delhi, India	2004-2008

## Research Experience

<b>Research Assistant</b> , GAMMA group, UNC Chapel Hill, USA <ul style="list-style-type: none"><li>Physically-based sound propagation for directional sources and listeners</li><li>Efficient HRTF computation using numerical simulation</li><li>Massively scalable numerical solver for CPU clusters</li><li>Hybrid sound propagation in large scenes using wave-ray coupling</li><li>Sound propagation in large outdoor scenes using equivalent source formulation</li><li>Efficient GPU-based solver for the acoustic wave equation in time-domain</li><li>Real-time sound propagation of dynamic sources in complex scenes</li><li>Touch-enabled virtual percussion instruments</li></ul>	(2009 – Present)
<b>Summer Intern</b> , Natural Interactions Group, Microsoft Research, Redmond, WA <ul style="list-style-type: none"><li>Sound propagation engine for spatial augmented reality</li></ul>	2013
<b>Summer Intern</b> , Extreme computing group, Microsoft Research, Redmond, WA <ul style="list-style-type: none"><li>Spatial sound for wave-based sound propagation in time-domain</li></ul>	2012
<b>Summer Intern</b> , Computer graphics group, Microsoft Research, Redmond, WA <ul style="list-style-type: none"><li>Directional sources for wave-based sound propagation in time-domain</li></ul>	2011
<b>Research Scholar</b> , IMAGER lab, University of British Columbia, Vancouver, Canada <ul style="list-style-type: none"><li>Shape abstraction for man-made shapes</li></ul>	(2008 –2009)
<b>Research Scholar</b> , Vision & Graphics group, IIT Delhi, India <ul style="list-style-type: none"><li>Visibility and surface reconstruction for noisy point cloud data</li><li>Realistic, real-time rendering of mesostructure, awarded <b>Best B.Tech Project</b> in comp. Sc. by IIT Delhi</li><li><i>Google Summer of Code, 2008</i>, Linden Labs (Second life) &amp; Google Inc.</li></ul>	(2006- 2008)
<b>Software Engineer (Summer Intern)</b> , Microsoft Corporation, India <ul style="list-style-type: none"><li>Validation accuracy of Microsoft's visual studio automated testing tool</li></ul>	2007
<b>Summer Internship</b> , LISA lab, University de Montreal, Montreal, Canada <ul style="list-style-type: none"><li>Unsupervised machine learning from television data using artificial neural networks</li></ul>	2006

## Publications

### Journal and Refereed Conference Papers

1. **Ravish Mehra**, Nikunj Raghuvanshi, Anish Chandak, Don Albert, Keith Wilson and Dinesh Manocha, "Acoustic pulse propagation in an urban environment using a three-dimensional numerical simulation", The Journal of the Acoustical Society of America (accepted).
2. **Ravish Mehra**, Atul Rugta, Abhinav Golas, Ming Lin and Dinesh Manocha, "WAVE: High-fidelity sound simulation system for VR applications", ISMAR 2014 (under review).
3. Alok Meshram, **Ravish Mehra**, Dinesh Manocha, "P-HRTF: Efficient Personalized HRTF Computation for High-Fidelity Spatial Audio", IEEE ISMAR 2014 (under review).
4. Alok Meshram, **Ravish Mehra**, Dinesh Manocha, "Efficient HRTF computation using adaptive rectangular decomposition", AES 55<sup>th</sup> International Conference, Spatial Audio 2014 (under review).
5. Carl Schissler, **Ravish Mehra**, Dinesh Manocha, "High-order diffraction and diffuse reflections for interactive sound propagation in large environments", ACM TOG (*conditionally accepted at SIGGRAPH 2014*).
6. **Ravish Mehra**, Lakulish Antani, Sujeong Kim, and Dinesh Manocha, "Source and Listener Directivity for Interactive Wave-based Sound Propagation", IEEE TVCG (*presented at VR 2014*).
7. Hengchin Yeh, **Ravish Mehra**, Zhimin Ren, Lakulish Antani, Ming Lin, and Dinesh Manocha, "Wave-ray coupling for interactive sound propagation in large complex scene", ACM Transactions On Graphics (*presented at SIGGRAPH ASIA 2013*).
8. **Ravish Mehra**, Nikunj Raghuvanshi, Lakulish Antani, Anish Chandak, Sean Curtis, Dinesh Manocha, "Wave-Based Sound Propagation in Large Open Scenes using an Equivalent Source Formulation", ACM TOG (*presented at SIGGRAPH 2013*).
9. **Ravish Mehra**, Nikunj Raghuvanshi, Lakulish Antani, Dinesh Manocha, "A real-time sound propagation system for noise prediction in outdoor spaces", INTERNOISE 2012, New York.
10. Zhimin Ren, **Ravish Mehra**, Jason Coposky, Ming Lin, "Tabletop Ensemble: Touch-Enabled Virtual Percussion Instruments", ACM Symposium on Interactive 3D Graphics and Games (I3D) 2012.
11. **Ravish Mehra**, Nikunj Raghuvanshi, Lauri Savioja, Ming C. Lin, Dinesh Manocha, "An efficient GPU-based time-domain solver for the acoustic wave equation", Applied Acoustics, Elsevier 2011.
12. Nikunj Raghuvanshi, John Snyder, **Ravish Mehra**, Ming C. Lin, Naga Govindaraju, "Precomputed Wave Simulation for Real-Time Sound Propagation of Dynamic Sources in Complex Scenes", ACM TOG (*presented at SIGGRAPH 2010*).
13. **Ravish Mehra**, Pushkar Tripathi, Alla Sheffer, Niloy J Mitra, "Visibility of Noisy Point Cloud Data", Special Issue of *Computers & Graphics - Elsevier* 2010 (*presented at Shape Modeling International 2010*).
14. **Ravish Mehra**, Qingnan Zhou, Jeremy Long, Alla Sheffer, Amy Gooch, Niloy J. Mitra, "Abstraction of Man-Made Shapes", ACM TOG (*presented at SIGGRAPH ASIA 2009*).
15. **Ravish Mehra**, Subodh Kumar, "Accurate and Efficient Rendering of Detail using Directional Distance Maps", Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP) 2012.

### Peer-Reviewed Workshops and Posters

1. **Ravish Mehra** and Dinesh Manocha, "Wave-based Sound Propagation for VR applications", Workshop on Sonic Interactions for Virtual Environments (*presented at IEEE VR 2014*).
2. Nikunj Raghuvanshi, **Ravish Mehra**, Dinesh Manocha, Ming Lin, "Adaptive rectangular decomposition: A spectral, domain-decomposition approach for fast wave solution on complex scenes", Acoustical Society of America, 2012, Kansas City.
3. **Ravish Mehra**, Nikunj Raghuvanshi, Lakulish Antani, Dinesh Manocha, "Real-time sound propagation and noise modeling in outdoor environments using Equivalent Source Formulation", Acoustical Society of America, 2012, Kansas City.

4. **Ravish Mehra**, Nikunj Raghuvanshi, Lauri Savioja, Ming Lin, Dinesh Manocha, "An efficient time domain solver for the acoustic wave equation", ACOUSTICS 2012, Hong Kong.
5. **Ravish Mehra**, Nikunj Raghuvanshi, Anish Chandak, Don Albert, Keith Wilson and Dinesh Manocha, "Validation of 3D numerical simulation for acoustic pulse propagation in an urban environment", ACOUSTICS 2012, Hong Kong.
6. **Ravish Mehra**, Nikunj Raghuvanshi, Lauri Savioja, Ming Lin, Dinesh Manocha, "An efficient time domain solver for the acoustic wave equation", ACOUSTICS 2012, Nantes.
7. Zhimin Ren, **Ravish Mehra**, Jason Coposky, Ming Lin, "Designing Virtual Instruments with Touch-Enabled Interface", case study at SIGCHI 2012.
8. Nikunj Raghuvanshi, John Snyder, **Ravish Mehra**, Ming C. Lin, Naga Govindaraju, "Real-time auralization of wave simulation in complex three-dimensional acoustic spaces", Acoustical Society of America 2011, Seattle.
9. Hengchin Yeh, **Ravish Mehra**, Zhimin Ren, Lakulish Antani, Ming Lin, and Dinesh Manocha, "Wave-ray coupling for interactive sound propagation in large complex scene", NC-Acoustical Society of America, Poster presentation (Best Poster Award)

## Invited Talks

1. **Real-time sound propagation system for noise prediction in outdoor spaces**, Meeting of North Carolina Chapter of Acoustical Society of America, Raleigh, North Carolina, 2013
2. **Noise prediction based on 3D numerical simulation in urban environments**, Meeting of North Carolina Chapter of Acoustical Society of America, Raleigh, North Carolina, 2013
3. **Making virtual world look and sound better**, CS dept. at The City University of Hong Kong, Hong Kong, 2012
4. **Wave-based sound propagation in large open scenes using an equivalent source formulation**, Microsoft Research, Redmond, WA, 2012
5. **Visibility of noisy point cloud data**, India Institute of Technology, Delhi, India 2010

## Patent Applications

1. **Source and listener directivity for interactive wave-based sound propagation**, Ravish Mehra, Lakulish Antani, and Dinesh Manocha, US Patent Application 61/841,910.
2. **Simulating sound propagation using wave-ray coupling**, Hengchin Yeh, Ravish Mehra, Lakulish Antani, Zhimin Ren, Ming Lin, and Dinesh Manocha, US Patent Application 61 /845,357.
3. **Sound propagation in large scenes using equivalent sources**, Ravish Mehra and Dinesh Manocha, US Patent Application 61/614,468

## Fellowships and Awards

1. **Royster Student Scholarship Award**, Acoustical Society of America, 2013
2. **Link Foundation Fellowship in Advanced Simulation and Training**, Link Foundation, 2013
3. **Best Bachelor of Technology Project Award**, IIT Delhi, 2008
4. **Google Summer of Code**, Linden Labs and Google Inc., 2008

## Activities

### Technical Paper Reviewing

ACM I3D 2014

ACM SIGGRAPH Asia 2012, Transactions on Audio, Speech and Language Processing 2012

ACM SIGGRAPH 2011, Computer Graphics Forum 2011

## Skills

**Languages:** C/C++, C#, JAVA, CUDA, OpenMP

**API/Toolkit:** FASTBEM, BTM toolbox, FFTW, MKL, DirectX/OpenGL, SVN, CGAL

**Applications:** Visual Studio, MATLAB

## Selected Advanced Coursework

Advanced Computer Graphics, Parallel and Distributed Computing, Computational Geometry, Physically-based Modeling, Image Processing and Analysis, Computer Vision, Numerical Scientific Computing

## Hobbies, Clubs and Certifications

ACM Student Member

Graduate and Profession Student Federation (Senator 2013)

Acoustical Society of America Member

IEEE Student Member