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Chad McKell

ABOUT

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Research I am a Ph.D. student at UC San Diego. In my research, I develop computational and mathematical methods for acoustic simulation. Topics of interest include virtual acoustics, sound synthesis, and differential geometry. My research has applications in music, animation, virtual reality, and other fields.

Ongoing research projects include: wave-based simulations of head-related transfer functions and 3D acoustic spaces; geometric methods for handling acoustic boundary conditions, including Kelvin transformations and perfectly matched layers; and parallelization of finite-difference time-domain solvers.

EDUCATION

9/19– **University of California San Diego**, Ph.D. in Computer Music
GPA: 4.0. Dissertation: *Geometric Boundary Methods for Wave Simulations*.
Advisors: Miller Puckette and Albert Chern.
9/16–10/17 **University of Edinburgh**, M.S. in Acoustics and Music Technology
8/09–12/15 **Wake Forest University**, M.S. in Physics
6/02–8/09 **Brigham Young University**, B.S. in Biophysics

EMPLOYMENT

9/19– **University of California San Diego**, Teaching Assistant/Researcher (Music)
8/21–3/22 **Meta, Reality Labs Research**, Research Intern/Student Researcher (Acoustics)
7/18–7/19 **Applied Research in Acoustics**, R&D Scientist (Acoustics)
5/18–5/18 **Moog Music**, Freelance Software Developer (Audio DSP)
4/17–9/17 **Lofelt**, Freelance Simulation Researcher (Physics)
10/14–8/16 **J.P. Morgan/Neovest**, Consulting Software Development Engineer in Test (QA)
9/12–12/12 **University of North Carolina School of the Arts**, Adjunct Instructor (Physics)
9/09–9/11 **Wake Forest University**, Teaching Assistant (Physics)
9/08–6/09 **Brigham Young University**, Tutorial Lab Assistant (Physics)
8/07–3/09 **Brigham Young University**, Research Assistant (Philosophy)

RESEARCH ACTIVITIES

9/19– **University of California San Diego**, Ph.D. Student
La Jolla, California. Research areas: *acoustics*, *applied mathematics*. Develop differential geometric methods for handling boundary conditions in wave simulations. Research topics include virtual acoustics, differential geometry, scientific computing, and partial differential equations. Committee members: Miller Puckette (co-chair, Music), Albert Chern (co-chair, CSE), Melvin Leok (Math), Shahrokh Yadegari (Music), Stefan Bilbao (Music, University of Edinburgh), and Sebastian Prepelitã (Audio, Reality Labs Research at Meta).

RESEARCH ACTIVITIES CONT.

- 8/21–3/22 **Meta, Reality Labs Research**, Research Intern/Student Researcher
La Jolla, California. Research areas: *acoustics, applied mathematics*. Conducted computational acoustics research for virtual and augmented reality devices. Research topics included binaural audio, numerical simulation, parallel programming, and discrete complex analysis. Supervisor: Sebastian Prepelîță. Team Lead: Ravish Mehra.
- 7/18–7/19 **Applied Research in Acoustics**, R&D Scientist
Culpeper, Virginia. Research areas: *acoustics, digital signal processing*. Developed physics-based signal processing algorithms for naval sonar systems. Research topics included underwater acoustics, matched filtering, sparse estimation, and beamforming. Team Lead: Jonathan Botts.
- 1/17–8/17 **University of Edinburgh**, Master’s Student
Edinburgh, Scotland. Research areas: *acoustics, digital signal processing, elastodynamics*. Developed physics-based numerical simulations of speech sounds and structural vibrations. Research topics included speech acoustics, modal synthesis, and finite-difference time-domain methods. Research was partially funded by Lofelt, a Berlin-based haptic feedback company acquired by Meta in 2022. Advisor: Stefan Bilbao.
- 1/10–9/13 **Wake Forest University**, Master’s Student
Winston-Salem, North Carolina. Research areas: *optics, fluid dynamics*. Implemented transverse nanoparticle tracking in surface-isolated laser traps. Research topics included optical trapping, laser beam characterization, and fluid diffusion. Advisor: Keith Bonin.
- 8/07–8/09 **Brigham Young University**, Undergraduate Student
Provo, Utah. Research areas: *biophysics, structural biology*. Analyzed physical features of lipid bilayers using atomic force microscopy. Research topics included cellular membrane biology and scanning probe microscopy. Advisor: David Busath.

TEACHING EXPERIENCE

UCSD

- MUS 5 Sound in Time—*TA*. Spring 2020 (1 term).
MUS 6 Electronic Music—*TA*. Fall 2020 (1 term).
MUS 15 Popular Music: David Bowie—*TA*. Winter 2021 (1 term).
MUS 15 Popular Music: Video Game Music—*TA*. Winter 2020 (1 term).
MUS 171 Computer Music I—*TA*. Winter 2022 (1 term).
MUS 172 Computer Music II—*TA*. 2021–2022 (2 terms).

UNCSA

- SCI 1100 General Physics—*Instructor*. Fall 2012 (1 term).

WFU

- PHY 113 General Physics I (Mechanics)—*TA*. 2009–2011 (4 terms).
PHY 114 General Physics II (E&M)—*Tutor*. Fall 2010 (1 term).

BYU

- PHSCS 105 General Physics 1 (Mechanics)—*Tutor*. 2008–2009 (2 terms).
PHSCS 106 General Physics 2 (E&M)—*Tutor*. Winter 2009 (1 term).
PHSCS 121 Principles of Physics 1 (Mechanics)—*Tutor*. 2008–2009 (2 terms).
PHSCS 123 Principles of Physics 2 (Waves/Thermo)—*Tutor*. W/Sp 2009 (2 terms).
PHSCS 220 Principles of Physics 3 (E&M)—*Tutor*. W/Sp 2009 (2 terms).

PH.D. COURSEWORK

CSE 167	Computer Graphics I (Jürgen Schulze)
CSE 169	Computer Animation— <i>audit</i> (Steve Rotenberg)
CSE 274	Discrete Differential Geometry (Albert Chern)
CSE 291	Physical Simulation— <i>audit</i> (Steve Rotenberg)
CSE 299	Differential Geometry Research (Albert Chern)
MUS 206	Spatialization (Shahrokh Yadegari)
MUS 206	Deep Learning for Music Generation (Shlomo Dubnov)
MUS 206	Computational Acoustic Modeling (Tamara Smyth)
MUS 270A	Digital Audio Processing (Tamara Smyth)
MUS 270B	Analysis of Musical Sound (Miller Puckette)
MUS 270C	Compositional Algorithms (Miller Puckette)
MUS 270D	Advanced Projects in Computer Music (Puckette/Smyth)
MUS 298	Virtual Acoustics Research (Puckette/Smyth/Dubnov)
MUS 298	Differential Geometry Research (Miller Puckette)

PUBLICATIONS

Journal Articles

- (1) **C. McKell** and K. Bonin, “Optical corral using a standing-wave Bessel beam,” *Journal of the Optical Society of America B*, Vol. 35, No. 8, 1910–1920, 2018.

Conference Proceedings

- (2) **C. McKell**, “Sonification of optically-ordered Brownian motion,” In Proceedings of the International Computer Music Conference (ICMC), Utrecht, Netherlands, September 2016.

Master’s Theses

- (3) **C. McKell**, *Real-time physical modeling for haptic feedback rendering*, Final Project Dissertation, University of Edinburgh, Acoustics and Audio Group, 2017. (Advisor: Stefan Bilbao).
- (4) **C. McKell**, *Finite-difference simulations of speech with wall vibration losses*, Special Project Dissertation, University of Edinburgh, Acoustics and Audio Group, 2017. (Advisor: Stefan Bilbao).
- (5) **C. McKell**, *Confinement and tracking of Brownian particles in a Bessel beam standing wave*, Master’s Thesis, Wake Forest University, Department of Physics, 2015. (Advisor: Keith Bonin).

Technical Reports

- (6) **C. McKell**, H. Conley, and D. Busath, “AFM study of structural changes in supported planar DPPC bilayers containing general anesthetic isoflurane,” Brigham Young University, Paper 827, 2010.