Chad McKell

ABOUT

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Research — I am a Ph.D. candidate at UC San Diego based in the Center for Visual Computing and the Department of Music. I am interested in geometric modeling and numerical simulation of acoustic phenomena for applications in audio technology, hearing science, and computer graphics. Research topics include fluid-structure interactions in wind instruments and the human cochlea; boundary modeling in virtual acoustics simulations; and parallelization of numerical integrators.

EDUCATION

9/19– **University of California San Diego**, Ph.D. in Computer Music
GPA: 4.0. Dissertation: *Geometric Methods for Acoustic Simulation.*
Advisors: Albert Chern (CSE) and Miller Puckette (Music).

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 Audio Software Developer (Audio DSP)
4/17–9/17 **Lofelt**, Freelance Acoustic Simulation Researcher (Acoustics)
10/14–8/16 **J.P. Morgan/Neovest**, Consulting Software Development Engineer in Test (QA)
8/12–12/12 **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/Candidate
La Jolla, California. Research areas: *acoustics, applied mathematics.* Develop geometric methods for simulating acoustic phenomena in musical instruments, the human cochlea, and 3D acoustic spaces. Research topics include virtual acoustics, differential geometry, scientific computing, and partial differential equations. Committee members: Albert Chern (co-chair, Computer Science and Engineering), Miller Puckette (co-chair, Music), Melvin Leok (Mathematics), Shahrokh Yadegari (Music), Stefan Bilbao (Music, University of Edinburgh), and Sebastian Prepeliță (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 Prepeliță. 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, elasto-dynamics.* 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.* Studied the effect of anesthetics on lipid bilayer structure using atomic force microscopy. Research topics included cellular membrane biology, vesicle fusion, 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—*audit* (Steve Rotenberg)
CSE 274	Discrete Differential Geometry (Albert Chern)
CSE 291	Physical Simulation—*audit* (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

Manuscripts in Progress

(1) **C. McKell**, M. Nabizadeh, S. Wang, and A. Chern, "Wave simulations in infinite spacetime". Submission planned for June 2023.

(2) **C. McKell** and S. Prepeliță. Topic: simulations of head-related transfer functions. Submission planned for 2023 or 2024.

Journal Articles

(3) **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

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

Master's Theses

(5) **C. McKell**, *Real-time physical modeling for haptic feedback rendering*, Final Project Dissertation, University of Edinburgh, Acoustics and Audio Group, 2017. (Advisor: Stefan Bilbao).

(6) **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).

(7) **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

(8) **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.