# Chad McKell

## ABOUT

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| Address | 9500 Gilman Dr MC 0099 |
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Research     I am a Ph.D. candidate at UC San Diego based in the Department of Music and the Center for Visual Computing. In my research, I develop computational and mathematical methods for acoustic simulation. Topics of interest include differential geometry, virtual acoustics, sound synthesis, and hearing science. My research has applications in music, animation, virtual reality, audiology, and other fields.

Ongoing research projects include: differential geometric methods for handling infinite domains and complex obstacle boundaries in wave simulations; wave-based simulations of head-related transfer functions and 3D acoustic spaces; and parallelization of finite-difference time-domain wave solvers.

## EDUCATION

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| 9/19– | **University of California San Diego**, Ph.D. in Computer Music |
| | GPA: 4.0. Dissertation: *Kelvin Transformations 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

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|---|---|
| 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

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|---|---|
| 9/19– | **University of California San Diego**, Ph.D. Student/Candidate |
| | La Jolla, California. Research areas: *acoustics, applied mathematics*. Develop differential geometric methods for handling boundary conditions in wave simulations. Research topics include differential geometry, virtual acoustics, and scientific computing. 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 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**

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

**WFU**

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

**BYU**

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| 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

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|---|---|
| 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

### 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.