

Jatin Chowdhury

Audio Signal Processing Engineer

✉ jatin@ccrma.stanford.edu | 🏠 ccrma.stanford.edu/ jatin | 📧 jatinchowdhury18 | 📷 jatinchowdhury18

Education

Stanford University, Center for Computer Research in Music and Acoustics

Palo Alto, CA

M.A. IN MUSIC, SCIENCE, AND TECHNOLOGY

Sept. 2018 - June 2020

- Denning Family Fellowship for the 2018-2019 academic year.
- Relevant Coursework: Physical Audio Signal Processing, Time-Frequency Audio Signal Processing, Machine Learning, Digital Instrument Design, Spatial Audio, Music Recording.

University of Southern California

Los Angeles, CA

B.S. IN ELECTRICAL ENGINEERING

Aug. 2014 - May 2018

- USC Presidential Scholarship for outstanding academic achievement.
- Completed Minors in Physics and Music Recording.
- USC Renaissance Scholar certificate for excelling academically while pursuing separate fields of study.
- Relevant Coursework: Signal Processing, Circuit Design, Digital Logic, Electromagnetics, Software Design.

Experience

Chowdhury DSP

Denver, CO

AUDIO SIGNAL PROCESSING ENGINEER

Oct. 2021 - PRESENT

- Developed signal processing algorithms for real-time audio processing and synthesis.
- DSP algorithms include: virtual analog modelling, machine learning, and frequency-domain processing.
- Developed audio plugins including DSP, UI implementation, preset management, copy protection, installers, etc.
- Contributed to open-source audio plugins and signal processing libraries.

Tesla Motors

Palo Alto, CA

AUDIO TEST ENGINEER

Aug. 2020 - Oct. 2021

- Developed audio system signal flow layouts for vehicles using AudioWeaver.
- Contributed to audio system testing and tuning including telephony, equalization, and spatialization.
- Developed end-of-line tests to ensure vehicle audio system quality using Python and C++.
- Contributed to the signal processing and tuning for the vehicle pedestrian warning speaker.
- Contributed to testing and validation software for audio system firmware.

Persp3ctive VR

Los Angeles, CA

SOFTWARE/DSP ENGINEER

June 2019 - Mar. 2020

- Developed and implemented audio effects for use in a VR audio production environment including:
 - Parametric EQ, with smoothly varying parameters and five filter types.
 - Dynamic range compression, with virtual analog models of an optical compressor, and output transformer.
- Implemented the audio effects as an audio plugin with a fully featured UI.
- Built DSP framework for integrating effects made by other engineers into the plugin.
- Implemented OSC communication for sharing parameters and metering data with VR headset.
- Developed unit testing framework to make overall software more robust.

Audioworks Technologies

Toronto, ON

SOFTWARE ENGINEER

July 2018 - Dec. 2018

- Member of of the SoundsUnite developement team: building a digital audioworkstation (DAW) using JUCE/C++.
- Developed DSP features for the application including panning algorithms, level detection, and "smart" track exporting.
- Developed UX features for the application including meters, file browsers, and tempo controls.
- Integrating the application file management system with the SoundsUnite web store.

McGill Space Institute

Montreal, QC

RESEARCH TRAINEE

May 2017 - Aug. 2017

- Recipient of an Undergraduate Student Research Award from the National Sciences and Engineering Research Council of Canada.
- Member of the CHIME/FRB Working Group: building a software pipeline to detect Fast Radio Bursts (FRBs).
- CHIME is a telescope in British Columbia; has detected more FRBs in the Northern Hemisphere than any other telescope to date.
- Developed a "Flux Estimator" module for the CHIME/FRB software pipeline: Use incoming data from the telescope to estimate the intrinsic brightness of the astrophysical source.
- Contributed to science and unit testing frameworks for the CHIME/FRB software pipeline.
- Presented work for CHIME/FRB Working Group and CHIME/FRB Pipeline Gamma Release.

USC Viterbi Academic Resources Center

ENGINEERING TUTOR

Los Angeles, CA

Aug. 2018 - May 2018

- Tutored undergraduate engineering students in math, physics, and electrical engineering classes.
- Served as a tutor for the university chapter of the Society of Hispanic Professional Engineers.
- Trained new tutors in interacting with students and presenting material in a clear, concise, and cohesive manner.

KXSC Radio

DISC JOCKEY, JAZZ DIRECTOR

Los Angeles, CA

Jan. 2015 - May 2018

- On-air host and disc jockey for live jazz radio program "Jam Sessions".
- Co-host of live radio talk-show programs "Squamous Science Hour", and "TeXulous Talk Show".
- KXSC Jazz Director tasked with researching, reviewing, and organizing jazz music for the station library.

iD Technology Camps

INSTRUCTOR

Denver, CO

May 2015 - Aug. 2016

- Taught students age 12-17 programming in C++ and Arduino.
- Taught students age 6-12 in building simple robots using LEGO Mindstorm kits.

Skills

Programming Languages

C/C++, Python, Bash, MATLAB, Faust, LaTeX, Rust, Javascript

Signal Processing

Virtual analog modelling, filter design, neural networks, time-frequency analysis

Frameworks

JUCE API, TensorFlow, Web Audio API, Arduino

Tools

CMake, Git, Linux CLI, Visual Studio, Xcode, GitHub Actions, Inno Setup

Publications

A Wave Digital Filter Modeling Library for the Faust Programming Language

June 2021

PROC. OF THE 18TH SOUND AND MUSIC COMPUTING CONFERENCE

Torino, IT

- Co-authored with Dirk Roosenburg, Eli Stine, and Romain Michon.
- Available on GitHub.

RTNeural: Fast Neural Inferencing for Real-Time Systems

June 2021

ARXIV E-PRINTS: AUDIO AND SPEECH PROCESSING

Online

- Presents a neural network inferencing library for real-time systems.
- Available on the ArXiv.

Water Bottle Synthesis with Modal Signal Processing

Sept. 2020

PROC. OF THE 23RD INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Vienna, Austria

- Presented at the DAFx-2020 conference.
- Available on the DAFx Archives.

Stable Structures for Nonlinear Biquad Filters

Sept. 2020

PROC. OF THE 23RD INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Vienna, Austria

- Presented at the DAFx-2020 conference.
- Available on the DAFx Archives.

Real-Time Physical Modelling for Analog Tape Machines

Sept. 2019

PROC. OF THE 22ND INTERNATIONAL CONFERENCE ON DIGITAL AUDIO EFFECTS

Birmingham, UK

- Presented at the DAFx-2019 conference.
- Available on the DAFx Archives.

The CHIME Fast Radio Burst Project: System Overview

Aug. 2018

THE ASTROPHYSICAL JOURNAL

Vol. 836, No. 1

- Co-authored with the CHIME/FRB Collaboration
- Available on the ArXiv.

Presentations

Analog Modelling with Wave Digital Filters in C++

December 2021

THE AUDIO PROGRAMMER MONTHLY MEETUP

London, UK

- Discussed the basic formulation of Wave Digital Filters (WDFs) as a technique for modelling analog circuits.
- Discussed two approaches for implementing WDFs in C++, with trade-offs between flexibility and performance.
- Demonstrated example applications of WDF models in developing digital audio effects.

CI/CD for Audio Plugin Development

AUDIO DEVELOPER CONFERENCE

November 2021

London, UK

- Discussed the basic concepts and motivations for continuous integration and continuous deployment (CI/CD).
- Discussed the usefulness of CI/CD for developing audio plugins.
- Demonstrated several CI/CD workflows in the context of audio plugin development.

Creating Audio Effect Plugins for the 21st Century

SARC VIRTUAL EVENTS SERIES

February 2021

Belfast, UK

- Presented at the Sonic Arts Research Centre (SARC) at Queen's University Belfast.
- Presented a paradigm for developing original and innovative digital audio software.
- Discussed techniques and philosophies for designing audio software as part of a creative process, including signal processing algorithms and user interfaces.

A Comparison of Virtual Analog Modelling Techniques

AUDIO DEVELOPER CONFERENCE

November 2020

London, UK

- Presented a virtual analog model of the Klon Centaur guitar pedal developed using multiple modelling techniques, including nodal analysis, Wave Digital Filters, and Recurrent Neural Networks.
- An accompanying paper is published on the ArXiv.

Complex Nonlinearities for Audio Signal Processing

CCRMA DSP SEMINAR

May 2019

Stanford, CA

- Presented at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University.
- Presented a series of audio effects constructed from innovative uses of nonlinear signal processing techniques.
- Audio effects presented include harmonic exciters, hysteresis, nonlinear filters, subharmonics generators, and more.

Exploring Real-Time DSP Systems for Mixing and Performance

CCRMA DSP SEMINAR

Apr. 2019

Stanford, CA

- Presented at the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University.
- Presented overview of previous research and projects to an audience of peers, professors, and the public.
- Discussed topics including real-time timbral conversion, methods of integrating "imperfection" into audio DSP systems, and designing user interfaces for DSP systems as an extension of the DSP systems themselves.

Research

Differentiable Wave Digital Filters

LEAD RESEARCHER

July 2021 - PRESENT

- Demonstrated a process for constructing Wave Digital Filter (WDF) circuit models, in conjunction with neural network models of specific circuit elements.
- Developed a Python library for creating differentiable WDF models, allowing them to be trained via backpropagation.
- Project documentation is available on GitHub.

Real-Time Neural Network Inferencing

LEAD RESEARCHER

Stanford, CA

June 2020 - June 2021

- Developed a C++ library for performing neural inferencing for real-time audio systems.
- Developed benchmarks to compare the library performance with the PyTorch C++ API.
- Project documentation is available on GitHub.

Klon Centaur Emulation

LEAD RESEARCHER

Stanford, CA

Mar. 2020 - Aug. 2020

- Developed a digital emulation of the Klon Centaur guitar distortion pedal.
- Used circuit modelling methods including nodal analysis, Wave Digital Filters, and Recurrent Neural Networks.
- Developed emulation as an audio plugin and guitar pedal using an Arduino Teensy microcontroller.
- Project documentation is available on GitHub.

Modal Waterbottles

RESEARCHER

Stanford, CA

June 2019 - April 2020

- Worked with a team of researchers to develop acoustical models of water bottles using modal signal processing.
- Developed a real-time water bottle synthesizer using the JUCE framework.
- Project documentation is available on GitHub.

Complex Nonlinearities

LEAD RESEARCHER

Aug. 2019 - June 2020

- Built frameworks for developing complex nonlinear audio signal processors.
- Developed a series of open-source plugins to demonstrate the nonlinear frameworks.
- Published a series of Medium articles explaining nonlinear signal processing techniques for a non-technical audience.
- Project documentation can be found on GitHub.

Bad Circuit Modelling

LEAD RESEARCHER

Nov. 2019 - June 2020

- Researched methods for virtual analog circuit modelling to account for imperfections that exist in real-world circuits.
- Developed simulations and real-time circuit-modelling systems that accurately model the aging and component tolerances of resistors and capacitors.
- Project documentation can be found on GitHub.

Analog Tape Modelling

LEAD RESEARCHER

Stanford, CA

Jan. 2019 - Apr. 2019

- Researched and developed a physical model of an analog, reel-to-reel tape machine.
- Modelled the nonlinear process of analog tape recording using the Jiles-Atherton model for magnetic hysteresis.
- Modelled other effects created by analog tape machines, including flutter, playhead loss effects, and biasing effects.
- Developed an open-source audio plugin implementing the analog tape model as a real-time system. Source code and documentation are available on GitHub.

notGuitar

RESEARCH PARTNER

Los Angeles, CA

Jan. 2018 - May 2018

- notGuitar is real-time timbral conversion system designed to process a guitar input signal to sound like a saxophone.
- notGuitar was implemented using a Texas Instruments DSK6713 DSP board in May 2018.
- Documentation for the project can be found on GitHub.

Projects

Chowdhury DSP

FOUNDER, ENGINEER

June 2018 - PRESENT

- Developed audio plugins including:
 - ChowTapeModel: An analog tape emulation based on the DAFx-19 paper “Real-Time Physical Modelling for Analog Tape Machines”.
 - ChowMatrix: A dynamic matrix of stereo delay effects.
 - ChowKick: A kick drum synthesizer based on creative circuit modelling.
 - ChowCentaur: A digital emulation of the Klon Centaur distortion pedal, using Wave Digital Filters and recurrent neural networks.
 - ChowPhaser: A phaser effect based loosely on the Schulte Compact Phasing ‘A’ circuit.
- Contributed audio effects and other DSP code to the open-source Surge Synthesizer project.
- Developed modules for the VCV Rack modular synthesis environment.
- For more information, see the Chowdhury DSP website.

Wave Digital Filters

PROGRAMMER

Jan. 2020 - PRESENT

- Created a minimal C/C++ Library for modelling circuits with Wave Digital Filters (WDFs).
- Currently includes WDF implementations for basic circuit elements (resistors, capacitors, inductors), basic circuit adaptors (series, parallel), “1-port” nonlinear circuit elements, and “R-Type” adaptors.
- Includes several example WDF models implemented as audio plugins using the JUCE framework, as well as a graphical WDF prototyping tool.
- Developed an auxiliary script for deriving scattering matrices for “R-Type” adaptors.
- Ongoing development and documentation can be found on GitHub.

audio-dspy

PROGRAMMER

Oct. 2019 - June 2020

- Created a Python package for audio signal processing.
- Currently includes tools for filter design, impulse response manipulation, modal modelling, and nonlinear processing.
- Development and documentation can be found on GitHub.

NewMixer

CREATOR

Dec. 2018 - Dec. 2019

- A unique digital audio workstation designed to break away from the traditional “virtual console” user interface.
- Individual audio sources are visualized as sound sources in a room; the user can arrange the sources to create a mix with stereo width, and reverberative depth.
- NewMixer is currently a fully functional mixing tool, supporting saving, exporting, automation, plugin hosting and more.
- Documentation of NewMixer can be found on GitHub.

The SGUM (Squamous Geometrically Uncanny Matrix)

Stanford, CA

CREATOR

Mar. 2019

- The SGUM is an expressive standalone drum machine, comprised of nine velocity-sensitive drum pads, with programmable samples and configurations.
- Designed and built from the SGUM from scratch, including drum pads, circuitry, frame, etc.
- Programmed firmware for the SGUM, which runs on a Teensy 3.6 microcontroller with an audio shield and uses embedded Faust processing.
- The entire process was completed in two weeks, and for less than \$100 USD.
- Documentation for the SGUM can be found on YouTube.

NoLava Recording Studios

Los Angeles, CA

CO-FOUNDER, AUDIO ENGINEER, TECHNICAL ADVISOR

Aug. 2017 - July 2018

- Recorded, mixed, and mastered for artists of various styles including acoustic, electronic, rock, country, and punk.
- Installed, repaired, and maintained speakers, microphones, keyboards, amplifiers, and other studio equipment.