

# ADWAY GIRISH

SENIOR UNDERGRADUATE

ELECTRICAL ENGINEERING, IIT BOMBAY

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## EDUCATION

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**Indian Institute of Technology Bombay (IITB)**

Mumbai, India

Bachelor of Technology in Electrical Engineering (EE), **CGPA 9.60/10**

Jul. 2018 – Present

- **Honors** in Electrical Engineering and **Minor** in Mathematics
- Ranked **5<sup>th</sup>** in the Department out of 65 students

## ACADEMIC ACHIEVEMENTS

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- Recipient of an **Institute Academic Prize** for being the second-best academic performer in the EE department [2020-21]
- Extended a full-time offer by Texas Instruments (India) following an **excellent internship performance** [Summer 2021]
- Received an **Undergraduate Research Award** (URA01) from IITB in recognition of a developmental effort in research for work done in Radar Signal Processing [2020]
- Awarded an **AP grade** (given to the top 2% of students) in two courses at IITB - Digital Communications, and Data Analysis and Interpretation - for exceptional performance [Spring 2021, Autumn 2019 resp.]
- Granted the **Urvish Medh Memorial Prize** for being the highest-ranked student in the EE department, IITB [2018]
- Secured **All-India Ranks** of **43** out of 155,158 participants in **JEE(Advanced)** and **55** out of 1,259,000 in **JEE(Main)**, standing first in the state of Karnataka in both [2018]
- Among the top 40 and 49 students chosen for the final camp to select **the team to represent India** at **International Olympiads** on Astronomy and Astrophysics and Chemistry (IOAA and IChO respectively) [2018]
- Selected for the **Kishore Vaigyanik Protsahan Yojana** fellowship (in Basic Sciences, initiated and funded by the Department of Science and Technology, Government of India) by securing an **All-India Rank** of **35** [2016]
- Awarded the prestigious **National Talent Search** scholarship (NTS) by the National Council of Educational Research and Training (NCERT), offered to around 1000 students all over India [2016]

## RESEARCH PROJECTS AND INTERNSHIPS

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**Memoryless Broadcast Channels With Feedback**

R&D Project

Guide: Prof. Sibi Raj Pillai, EE Dept., IITB 📧

Jul. 2021 – Present

The capacity of single-user memoryless channels cannot be increased by causal feedback. We study the possible capacity enlargement provided by noisy feedback for two-user Broadcast Channels (BC).

- Obtained the maximum feedback erasure probability that can provide any improvement in the binary erasure BC
- Currently looking to characterize capacity of the Gaussian BC with 1-bit quantized output (QBC) with feedback
- Studying linear feedback coding schemes to achieve capacity enlargement for the QBC

**Spatially Coupled LDPC Codes Over Fading Channels**

B.Tech Project

Guide: Prof. Kumar Appaiah, EE Dept., IITB 📧

Jul. 2021 – Nov. 2021

Spatial coupling of LDPC codes has been shown to improve error performance, with high-complexity MAP thresholds under low-complexity BP decoding. We studied their performance over correlated, continuously-varying fading channels.

- Conducted literature review to understand why performance improves over conventional LDPC codes
- Analysed the best performance possible over fading channels using interleaving, subject to a latency-constraint
- Extended the application of low-complexity, reduced-latency windowed decoding to correlated fading channels without losing out significantly on performance

**Micro-Doppler Estimation in Radar Signal Processing**

Research Project

Guide: Prof. Vikram Gadre, EE Dept., IITB 📧

Apr. 2020 – Present

Radar signals are used in detecting position and motion parameters of objects. Rotating or vibrating parts produce sinusoidal variations in the frequency called the micro-Doppler (mD), in addition to shifts produced by translation.

- Studied the detection of mD parameters from Radar signals using Inverse Radon Transform and proposed an alternate algorithm to separate BD components using L-statistics
- Devised an algorithm to extract mD components by expressing the demodulated signal in terms of Bessel functions and filtering out appropriate elements
- Looking to generalize a finite-rate-of-innovation-based dual focusing approach to mD estimation

### Evaluation of Baseband Behavioural Models for Power Amplifiers

Summer Internship

Texas Instruments (India) Pvt. Ltd., Bangalore, India

May 2021 – Jul. 2021

Non-linearities in power amplifiers distort the signal and generate out-of-band components by causing the spectrum to spread. Removing them is essential to efficiently use the allocated bandwidth in wireless communication applications.

- Performed literature review of Volterra series and Memory Polynomial models and identified reasonable ones to pursue
- Implemented these models on MATLAB, obtaining considerable improvement over those currently in use
- Devised a ‘peeling’ algorithm to make the model implementable on an FPGA, hence ready for use in a real product

## TEACHING AND SEMINARS

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### Teaching Assistant

Autumn 2020, Spring 2020, Autumn 2019 resp.

MA109: Calculus I, PH108: Electricity and Magnetism, MA105: Calculus

- Mentored batches of 45+ students by taking weekly tutorial sessions and periodic doubt-clearing sessions
- Responsible for grading exam papers and assignments, and invigilation during exams

### Applications of Fourier and Hilbert Transforms in Communication Systems

April 2021

MA5106: Introduction to Fourier Analysis Seminar | Prof. Sanjoy Pusti, Mathematics Dept., IITB

- Presented applications of the Fourier and Hilbert transforms in Signal Processing and Communication to 20+ graduate students in mathematics, being the only engineering student in the class
- Demonstrated the intuition behind the transforms and a few examples of modulation and demodulation with a series of simulations on GNU Radio

### Wire-tap Channels and Secrecy in Communication

April 2021

EE708: Information Theory and Coding Course Project | Prof. Bikash Dey, EE Dept., IITB

- Studied and presented Wyner’s wire-tap channel to provide secrecy when the intended receiver is stronger
- Read about using a shared key to communicate confidentially even with a stronger eavesdropper

### Transform Domain Analysis in Electrical Engineering

October 2019

EE225: Network Theory Class Term Assignment | Prof. Vikram Gadre, EE Dept., IITB

- Presented the use of Transform Domain Analysis in Signal Processing to 100+ students and faculty from TEQIP-III (Technical Education Quality Improvement Programme, Govt. of India) colleges
- Talked about the recent generalizations of Fourier Transforms such as Fractional Fourier Transforms to deal with non-stationary signals

## OTHER PROJECTS

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### Bank Queue Simulator on Pt-51 Microcontroller

Mar. 2021 – Apr. 2021

EE337: Microprocessors Lab Project | Prof. Rajbabu Velmurugan, EE Dept., IITB

- Simulated the behaviour of a queue in a bank with four counters by distributing tokens to new customers as they arrive and allotting them to counters as they become free on a first-come-first-serve basis
- Interfaced a keyboard with the Pt-51 using UART to imitate the actions of the customers and tellers using keystrokes
- Displayed the token numbers being served at any moment on a  $16 \times 2$  LCD module, using Timer Interrupts to notify a counter becoming free and the token number allotted to it on the screen

### Audio Watermarking

Sep. 2020 – Dec. 2020

EE338: Digital Signal Processing Application Assignment | Prof. Vikram Gadre, EE Dept., IITB

- Conducted literature survey of various watermarking techniques and identified echo data hiding and phase coding as effective and feasible methods to pursue

- Implemented these two schemes on MATLAB and obtained virtually error-free recovery of the embedded messages without any perceptible degradation in quality of the original audio files

#### **Solar-Powered Street Light: Battery Management System**

Mar. 2021 – May 2021

*EE344: Electronic Design Lab Course Project | Prof. Joseph John, EE Dept., IITB*

- Implemented overcharge and undervoltage protection circuits for the LED load connected to a solar-charged battery
- Designed a PCB to make the circuit usable in a real product

## MENTORING AND RESPONSIBILITY

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#### **Institute Student Mentor**

Jun. 2021 – Present

*for incoming undergraduates at IIT Bombay*

- Mentoring 12 first-year students, helping them have a comfortable transition and adaptation to college life
- Acting as the single point of contact for any issues they may face, in particular ensuring that they have the resources to attend online classes from home

#### **Summer of Science Mentor for Signal Processing**

Summer 2019

*Math and Physics Club, IIT Bombay*

- Guided two students on a self-paced introduction to signal processing by helping them create an action plan, suggesting reference materials and reviewing their reports
- Curated mini-projects to provide hands-on experience - image compression using Haar wavelets, dual-tone multi-frequency generator and decoder, and identification of constituent instruments from simple music samples

#### **Class Representative**


Jul. 2018 – May 2019

*for the first-year batch of B.Tech in Electrical Engineering at IIT Bombay (69 students)*

- Created effective communication channels to ensure that all students were kept updated on relevant issues
- Mediated discussions between faculty and the class as a whole to allow for smooth proceedings of courses

## WORKSHOPS ATTENDED

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- JTG/IEEE Information Theory Society Summer School at IIT Kanpur  [Jun. 2021]
- Final stage of selection of the team to represent India at IOAA 2018 [Apr. – May 2018]
- Vijyoshi Camp at Indian Institute of Science, Bangalore [Dec. 2017]
- Space Camp at U.S. Space and Rocket Center, Huntsville, AL, USA [Mar. 2017]

## RELEVANT COURSEWORK

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- **Communication and Signal Processing:** Information Theory and Coding, Error Correcting Codes, Digital Communications, Communication Systems, Digital Signal Processing, Signals and Systems
- **Probability and Statistics:** Probability and Random Processes (Advanced and Basic), Estimation and Identification, Data Analysis and Interpretation
- **Mathematics:** Finite Fields and their Applications, Introduction to Fourier Analysis, Basic Algebra, Complex Analysis, Real Analysis, Differential Equations (Partial and Ordinary), Linear Algebra, Calculus
- **Miscellaneous:** Control Systems, Power Systems, Microprocessors, CMOS Analog Design, Digital Systems, Electronic Devices, Network Theory

## TECHNICAL SKILLS

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- **Languages:** Python, C++, Javascript, MATLAB, VHDL, HTML,  $\LaTeX$ , Markdown, Spice, Embedded C
- **Software:** Keil, GNU Radio, Xcircuit, Qt, Quartus, Eagle, AutoCAD, SolidWorks

## EXTRACURRICULARS

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- Completed an intermediate course in **Table Tennis** under the **National Sports Organization** at IIT Bombay [2018-19]
- Conferred the title of **Best All-Rounder** on graduation from Ryan International School, Bangalore [2016]
- Elected to the **Student Council** at Ryan International School as the **Deputy Education Minister** [2014-15]
- Completed 12 credits in practical examinations and 7 credits in theoretical examinations for **Electronic keyboard** from the **Trinity College of Music London**, a result of 6 years of musical training [2007-13]