Sreya Das

Quantum Optimal Control / Pulse Engineering / Control technologies | Postdoctoral Researcher

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Professional Summary

- Optimal Control applications for Quantum Systems
- Pulse engineering techniques for quantum systems using classical methods and optimization
- Experience in developing Matlab based control pulses for robust and physically realizable systems in quantum domain
- Strong theoretical background in control technologies for linear and nonlinear systems
- Interested in translating control and optimization expertise into industrial R&D roles (imaging, medical devices, sensing, quantum devices, quantum engineering, or control systems).

Technical Expertise

- **Advanced Control & Optimization** Robust optimal control (GRAPE, Krotov), nonlinear system analysis, observer design, constraint-aware optimization, numerical stability analysis
- **Algorithm Development** Scientific computing, simulation pipeline development, performance benchmarking, reproducible computational workflows
- **Software & Tools** MATLAB, Python (PyTorch), C, Simulink, PSCAD, RTDS/RSCAD
- **Systems Engineering** Modeling of dynamical systems, controller prototyping, experimental validation, hardware-emulator interfacing

Industry-Relevant Experience

Postdoctoral Fellow - Scientific Researcher — **Jan 2024 – Present**
Technical University of Munich (TUM) — *Garching, Germany*

- **Project: QuE-MRT-Revolutionizing cancer imaging through quantum technologies**, by **NVision Imaging Technologies GmbH - Ulm,** funded by **German Ministry of research, technology and space.**
- Developed, evaluated, and engineered robust optimal control pulses to tackle practical constraints, both state-dependent and state-independent.
- Built MATLAB simulation from the system dynamics to generate pulses using gradient-based optimization techniques to maximize fidelity.
- Collaborated with multi-disciplinary teams; communicated technical results via meetings and reports.

Doctoral Fellow — **2021 - 2023**
IIT, Bombay — *Mumbai, India*

- **Topic: Robust adiabatic pulse design for excitation under experimental constraints**
- Theoretical explanation of adiabatic pulses, limitations and improvements to mitigate the decoherence effect
- Simulation, implementation in practical field inhomogeneities and experimental validation of adiabatic composite pulses

Research Associate — **Jul 2023 – Aug 2023**
IIT Bombay — *Mumbai, India*

- Studied optimal sweep-rate selection for linear/nonlinear adiabatic supercycles for coherence transfer in coupled spin systems.
- Produced simulation-backed recommendations for robust performance across parameter uncertainty.

Significant Projects

CNOT gate design *Sep 2023 – Dec 2023, Postdoc, IIT Bombay*

- Designed control strategies for quantum gate synthesis - CNOT-type operations.
- Implemented numerical simulation and verification workflows in MATLAB.

Controller design and implementation of a generalized controller (PIDHO on industrial emulator) *2018 - 2021, PhD, IIT Bombay*

- Formulated generalized controller structure; validated stability/performance in simulation and experimental setup.
- Implemented and tested on ECP Industrial Emulator Model 220; documented results and tuning methodology.

Multi-area load frequency control with PID + fuzzy logic *2017, M.Tech, University of Calcutta*

- Built and simulated PI/PID controllers, tuning via Ziegler–Nichols; added fuzzy-logic layer to improve transients.

Education

Ph.D. (Systems and Control Engineering), IIT Bombay, India 2017 – 2023
Thesis: *Aspects of Control in Classical and Quantum Systems: Design and Implementation*
M.Tech (Electrical Engineering), University of Calcutta, India 2015 – 2017
B.Tech (Electrical Engineering), University of Calcutta, India 2012 – 2015
B.Sc (Physics), University of Calcutta, India 2009 – 2012

Selected Publications

- Sreya Das, and Navin Khaneja. Composite Pulse Combinations for Chirp Excitation. *Journal of Magnetic Resonance.*, DOI: 10.1016/j.jmr.2022.107359
- Sreya Das, Justin Jacob, and Navin Khaneja. Mechanism of chirp excitation. *Journal of Magnetic Resonance Open*, 10-11:100026, 6 2022.
- Justin Jacob, Sreya Das, and Navin Khaneja. A Concise Method of Pole Placement to Stabilize the Linear Time-Invariant MIMO System. *2019 Sixth Indian Control Conference (ICC)December 18-20, 2019. IIT Hyderabad, India.*
  DOI:10.1109/ICC47138.2019.9123210

Leadership & Teaching (Selected)

- Teaching Assistant, TUM Garching (Organic Chemistry Practical), 2024-present
- Teaching Assistant, IIT Bombay (Signals and Feedback Systems; Quantum Control), 2017–2022
- Hostel 11 Council, IIT Bombay: Mess Secretary (2019–2020); Photography Secretary (2021–2022)

Awards

- Swami Vivekananda (West Bengal Govt.) Merit-cum-means Scholarship
- AICTE Scholarship (GATE 2015, 2017)