Karan Mukhi

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Education

University of Oxford *DPhil (PhD) in Computer Science* *Oct 2021 – Present*
Supervised by Alessandro Abate in the Oxford Control and Verification group

- My research centres on robust optimisation for large-scale power-system problems.
- I work on aggregating and coordinating the flexibility in populations of 'flexible' devices, like EVs
- Technically this involves characterising feasible regions for active and reactive power consumption of flexible loads with temporally-coupled constraints, and feasible regions for aggregations of these loads
- More generally my research group focuses on control and formal verification of safety-critical systems

University of Manchester *MPhys Physics with Theoretical Physics (First Class)* *Sept 2015 – June 2019*

- Masters project: *Optimal projections of high-dimensional datasets.* The project involved solving a non-convex optimization problem defined on a compact manifold, we implemented various optimisation heuristics, including particle swarm and genetic algorithms to work on the Stiefel manifold

University of California, Santa Barbara *Study Abroad (First Class)* *Sept 2017 – June 2018*

Experience

National Grid, Electricity Transmission *Data Scientist* *Feb 2021 – Sept 2021*

- Modelled network congestion for various regional demand profile scenarios that are compatible with net zero
- Analysed power flows on transmission lines in the network to build models for predictive maintenance
- Built data pipelines to access historic active and reactive power flows through the network
- Developed Monte Carlo models to forecast leakage of SF6 (a potent greenhouse gas) from substation assets

Open Climate Fix *Software Developer* *Aug 2020 – Jan 2021*

- Led the development of a mobile app enabling users to upload street imagery of photovoltaic (PV) panels
- Part of an effort to create an open-source database of PV to improve forecasting of residential PV generation

Electron *Software Developer* *August 2019 – Feb 2020*

- Worked as a full-stack developer for a startup developing local flexibility markets for the energy sector
- Developed the UI, wrote RESTful API endpoints and smart contracts, and designed schemas for databases

Culham Centre for Fusion Energy *Student Researcher* *June 2017 – August 2017*

- Wrote a stochastic model for simulating the thermodynamic profiles of plasma filaments in a tokamak
- Validated the model against empirical data from MAST (an experimental fusion reactor)

Extracurricular

I take great satisfaction in building tangible things, I have built a boat and various pieces of furniture

I like bringing people together to dance, I recently started organising a small event at a venue in Oxford

Publications and Awards

- *Distributionally Robust Aggregation of Electric Vehicle Flexibility.* Best poster award at DTU PES Summer School: Optimization and AI Perspectives 2024 (link to talk)
- K. Mukhi, A. Abate, *An Exact Characterisation of Flexibility in Populations of Electric Vehicles* 2023 62nd IEEE Conference on Decision and Control (CDC)
- K. Mukhi *et al Robust Aggregation of Electric Vehicle Flexibility* Accepted at HSCC 2025
- K. Mukhi *et al Exact Characterization of Aggregate Flexibility via Generalized Polymatroids* Under Review
- F. Militello *et al A two-dimensional statistical framework connecting thermodynamic profiles with filaments in the scrape off layer and applications to experiments* Physics of Plasmas, vol. 25, no. 5, *2018*