Data & Decisions:
PhD Programmes in Optimization and Operational Research
and
Statistics
in Edinburgh

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THE UNIVERSITY
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Overview of Theme and Research Groups

- School of Mathematics comprised of 5 themes
- **Our Theme:** Data & Decisions
- **Research Groups:**
  1. Optimization & Operational Research: 15 academic staff, 1 postdoctoral researcher + 2 postdoctoral consultants, 24 PhD students
  2. Statistics: 24 academic staff, 2 postdoctoral researchers + 2 postdoctoral consultants, 33 PhD students
- **PhD Programmes:**
  1. PhD in Optimization and Operational Research (PhD Theme Representative: E. Alper Yıldırım)
  2. PhD in Statistics (PhD Deputy Theme Representative: Finn Lindgren)

What is a PhD?

- PhD stands for Doctor of Philosophphy.
- Highest level of academic qualification
- Research degree
- 3-4 years (training + extensive and original research + dissertation + oral defense)
- Original contribution to scientific literature
- Prerequisite for most academic positions and research-intensive positions in government and private research labs

Why Study in Edinburgh?

- International leader in the mathematical and computing aspects of optimization and operational research and statistics
- Highly reputed group members, as evidenced by Editorial Board Memberships in major international journals, international research awards, fellowships and other peer recognitions, and memberships of prestigious international societies
- Maxwell Institute jointly run by the University of Edinburgh and Heriot Watt University
- Active collaborations with several research groups in the UK and overseas
- Active collaborations with industry and government
- Bayes Centre, City Deal, vibrant tech sector with an interest in data science

Funding Opportunities

- School of Mathematics (stipend equivalent to UKRI stipend rates for a period of 4 years + research allowance + training allowance + a tuition waiver)
- EPSRC Doctoral Training Partnerships (DTPs) and Centres for Doctoral Training (CDTs)
  - Modelling, Analysis and Computation (MAC-MIGS) Centre for Doctoral Training
  - Edinburgh Earth, Ecology and Environment Doctoral Training Partnership (E4 DTP)
  - Satellite Data in Environmental Science – Centre for Doctoral Training (SENSE CDT)
- China Scholarship Council
- Carnegie Scholarships
- Externally funded projects
- International scholarships provided by other governments or funding agencies

About Optimization and Operational Research

- Active for nearly 25 years
- Highly recognised in the UK and beyond
- 15 academic staff

  - Miguel Anjos
  - Burak Buke
  - Chris Dent
  - Skarleth Carrales
  - Sergio García Quiles

  - Jacek Gondzio
  - Andreas Grothey
  - Akshay Gupte
  - Julian Hall
  - Jörg Kalcsics

  - Ken McKinnon
  - John Pearson
  - Lars Schewe
  - Kit Searle
  - E. Alper Yıldırım

- 1 postdoctoral research associate + 2 postdoctoral OR consultants

  - Stefano Cipolla

  - Zeynep Şuvak
  - Alemseged Weldeyesus

- 24 PhD students, about half of them previously completed the MSc in OR here!

Reputation

- Journal Editorships (Anjos, Dent, Garcia Quiles, Gondzio, Grothey, Hall, Kalcsics, Schewe, Yıldırım)
- Best Paper Awards
  - Bomze, Gollowitzer, and **Yıldırım**, *Journal of Global Optimization*, 2014
  - Huangfu & **Hall**, *Computational Optimization and Applications*, 2015
  - Huangfu & **Hall**, *Mathematical Programming Computation*, 2018
  - Burlacu, Egger, Gross, Martin, Pfetsch, **Schewe**, Sirvent, and Skutella, *Optimization and Engineering*, 2019
- EURO Excellence in Practice Award 2016 (Schewe et al.)
- Inria International Chair, Fellow of the Canadian Academy of Engineering (Anjos)
- Two Senior Members of IEEE (Anjos, Dent)
- Two EUROPT Fellows (Anjos, Gondzio)
- Fellow of IET, ORS, and Institution of Engineers in Scotland, EMS Impact Prize (Dent)
- PhD Student Prizes (12th and 13th AIMMS-MOPTA Optimization Modeling Competition)

Areas of Research Activity

- Computational Optimization and Software (Miguel Anjos, Skarleth Carrales Escobedo, Sergio Garcia Quiles, Jacek Gondzio, Andreas Grothey, Akshay Gupte, Julian Hall, Joerg Kalcsics, Ken McKinnon, John Pearson, Lars Schewe, E. Alper Yıldırım)
- Continuous Optimization (Miguel Anjos, Skarleth Carrales Escobedo, Jacek Gondzio, Andreas Grothey, Julian Hall, Ken McKinnon, John Pearson, E. Alper Yıldırım)
- Decision Making Under Uncertainty (Burak Büke, Chris Dent, Jacek Gondzio, Andreas Grothey, Akshay Gupte, Ken McKinnon, Lars Schewe)
- Future Energy Networks (Miguel Anjos, Sergio Garcia Quiles, Andreas Grothey, Akshay Gupte, Joerg Kalcsics, Lars Schewe)
- Integer and Combinatorial Optimization (Miguel Anjos, Sergio Garcia Quiles, Andreas Grothey, Akshay Gupte, Joerg Kalcsics, Lars Schewe)

Sample Research Projects in Optimization and Operational Research I

- Akshay Gupte
  Stochastic mixed-integer polynomial optimization with applications in resilient infrastructure and network design

- E. Alper Yıldırım
  Theoretical comparison and implementation of alternative convex relaxations of structured nonconvex optimization problems

- Andreas Grothey
  Scenario aggregation in stochastic programming (in particular with respect to Energy applications)
  Asynchronous decomposition for interior point methods (for a student with a programming interest)

- Burak Büke
  Design and Control of Service Systems with Heterogeneity: Modelling the Human Aspect (background in probability required)
  Subscription Based Online Systems: Pricing and Traffic Control (background in probability required)

Sample Research Projects in Optimization and Operational Research II

- Chris Dent
  Stochastic optimization for energy scenario analysis (in collaboration with Scottish government)
  Decision analysis for climate resilience

- Jacek Gondzio
  Cutting Plane Methods with Interior Point Solver
  Huge Scale Optimization with Inexact Newton Method

- Joerg Kalcsics
  Stochastic supply chain design

- John Pearson
  Optimization with PDE constraints: Modelling of such problems as well as numerical linear algebra for the resulting discretized systems

- Julian Hall
  High performance solution of large scale sparse LP problems with the simplex method

Sample Research Projects in Optimization and Operational Research III

- Lars Schewe
  Developing methods for challenging hydrogen network optimization problems
  Energy markets under uncertainty: Multilevel optimization models and solution methods
  Algorithms for structured mixed integer nonlinear programming

- Miguel Anjos
  Understanding the impacts of renewable energy generation on electricity grids
  Exact algorithms for AC optimal power flow
  Large-scale integration of prosumers into electricity markets and systems operation

Suggested Action Plan

- Check eligibility requirements `https://www.maths.ed.ac.uk/school-of-mathematics/studying-here/pgr/phd-application`
- Study theme and group pages in detail for research opportunities
  - ▶ Theme: `https://www.maths.ed.ac.uk/school-of-mathematics/research/data-decisions`
  - ▶ Optimization and Operational Research: `https://www.maths.ed.ac.uk/school-of-mathematics/research/data-decisions/optimization-and-operational-research`
  - ▶ Statistics: `https://www.maths.ed.ac.uk/school-of-mathematics/research/data-decisions/statistics`
- Identify potential supervisors and contact them to discuss research opportunities
- Submit your application online by **23 January 2023** to receive full consideration for admission and funding
- Contact me for any further questions: `E.A.Yildirim@ed.ac.uk`