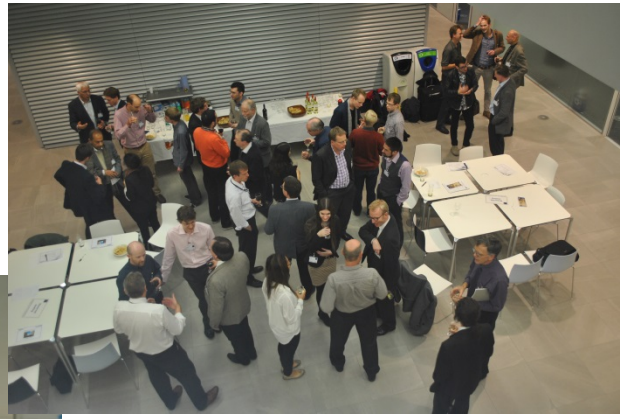
EPSRC
Engineering and Physical Sciences Research Council

InFoMM
Industrially Focused Mathematical Modelling

EPSRC Centre for Doctoral Training in Industrially Focused Mathematical Modelling

InFoMM



University of Oxford

Mathematical Institute

Key facts

InFoMM
Industrially Focused
Mathematical Modelling

- Our aim is to train next generation of applied mathematicians to fill critical roles in industry and academia
- CDT graduates will be adaptable problem-solvers armed with breadth of cutting-edge mathematical techniques and outstanding communication skills
- Many aspects of the training are undertaken in teams
- CDT has 40 partner companies spanning SMEs to multinationals. Companies are involved in training and research.
- Students will be able to interact with numerous partners at various levels

See http://www.maths.ox.ac.uk/InFoMM

Email: InFoMM@maths.ox.ac.uk

CDT Overview

InFoMM
Industrially Focused
Mathematical Modelling

The InFoMM CDT provides a four-year programme leading to a DPhil in maths

- There are over 40 Oxford academics involved
- Research topics include:
  - differential equations,
  - asymptotic methods,
  - numerical analysis,
  - scientific computing,
  - fluid and solid mechanics,
  - discrete mathematics,
  - applied mathematical finance,
  - data analytics
- We have fully funded scholarships for 12 students to start in 2015, including up to 4 from outside EU.

Overall Course structure

- The first six months involves intensive course-based learning (academic + interpersonal skills)
- The second six months involve undertaking two short mini-projects, at least one done at a company
- The remaining three years involve undertaking a mathematical research project tackling a challenge faced by one of our partner companies

1st year structure

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Week	W/C	Ox Term			Monday	Tuesday	Wednesday	Thursday	Friday
0	05-Oct	MT 0		Core Training	Introduction and orientation				
1	12-Oct	MT 1	AM		Mathematical Modelling				
			PM		Scientific Computing				
2	19-Oct	MT 2	AM		Mathematical Modelling				
			PM		Scientific Computing				
3-6	26-Oct	MT 3	AM		Modelling, Analysis and Computation of continuous real-world problems				Workshops
			PM						Skills
7-9	23-Nov	MT 7	AM		Modelling, Analysis and Computation of discrete real-world problems				Workshops
			PM						Skills
10	14-Dec	MT 10		IEP1	Industrial Enrichment Programme Courses				
11-12	21-Dec				Holiday				
13-14	04-Jan	HT -1			Industrial Enrichment Programme Courses				
15-22	18-Jan	HT 1	AM	Specialist Training	Maths for Energy	Continuum Methods in Industry	Contemporary Numerical Techniques	Mathematical Analytics	Workshops
			PM		Modelling case studies		Computing case studies		Skills
23	14-Mar	HT 9		IEP 2	IEP 2	UK Graduate Modelling Camp			
24	21-Mar	HT10			UK Study Group with Industry				
25	28-Mar				Holiday				
26	04-Apr				Holiday				
27-29	11-Apr	TT -1			Industrial Enrichment Programme Courses | Company Visits				
30	02-May	TT2		Miniprojects	Miniproject 1				
40	11-Jul				Holiday				
41	18-Jul				Miniproject 2				
51-52	26-Sep				Holiday				

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Company partners

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Potential projects

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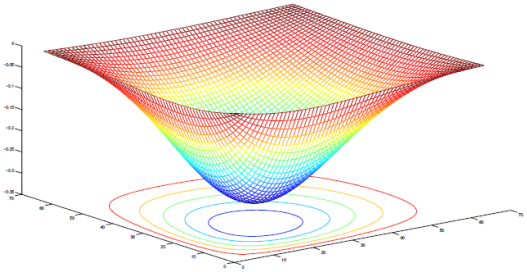
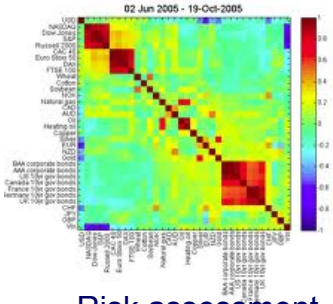
Particle transport
eg Membrane/filter fouling

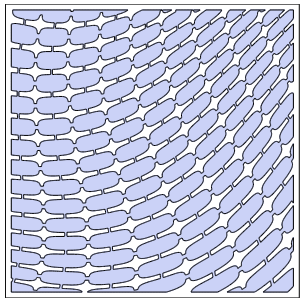


Numerical Analysis
eg Optimisation

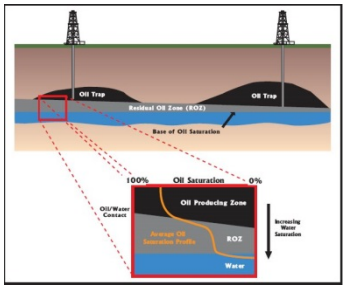


Risk assessment
eg Correlations in finance

Wave propagation
eg Radar



Mathematical Techniques
eg Homogenisation



Fluid mechanics
eg Oil recovery

Big Data
eg Tesco clubcard offers

Thermodynamics
eg Smelt furnaces

Aerodynamics
eg Wind Farms

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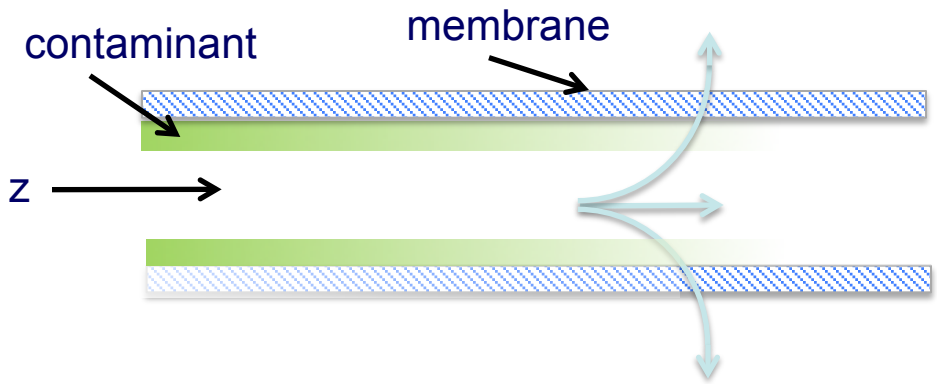
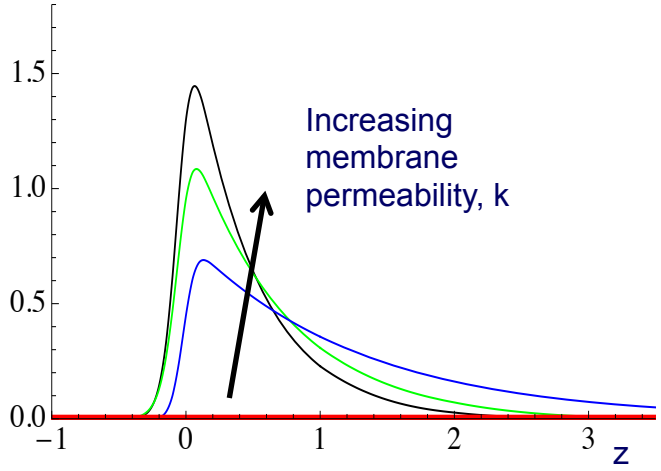
Optimizing membrane surface in cross-flow filtration

Contaminants will inevitably collect closer to the inlet, leading to sub-optimal use of available membrane surface.



Contaminant concentration on membrane surface



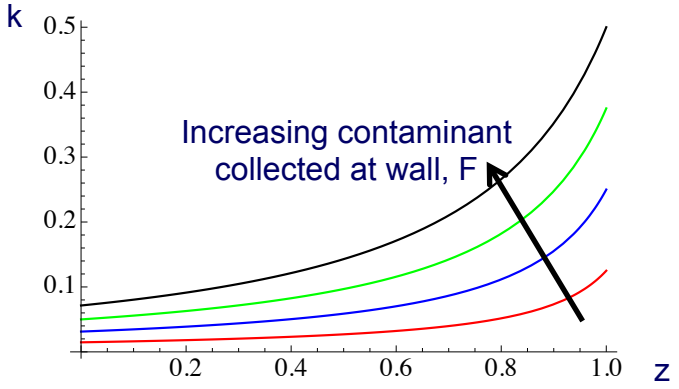
We can tailor the membrane permeability, k, to ensure an equal deposit of contaminant at each position on the membrane wall:

fraction of contaminant trapped by membrane

$$k = \frac{F}{4\phi\left[2F(z^2-1)+8(1-z)+\mathcal{P}\right]}$$

porosity

pressure



Minimizing energy expended in cross-flow filtration

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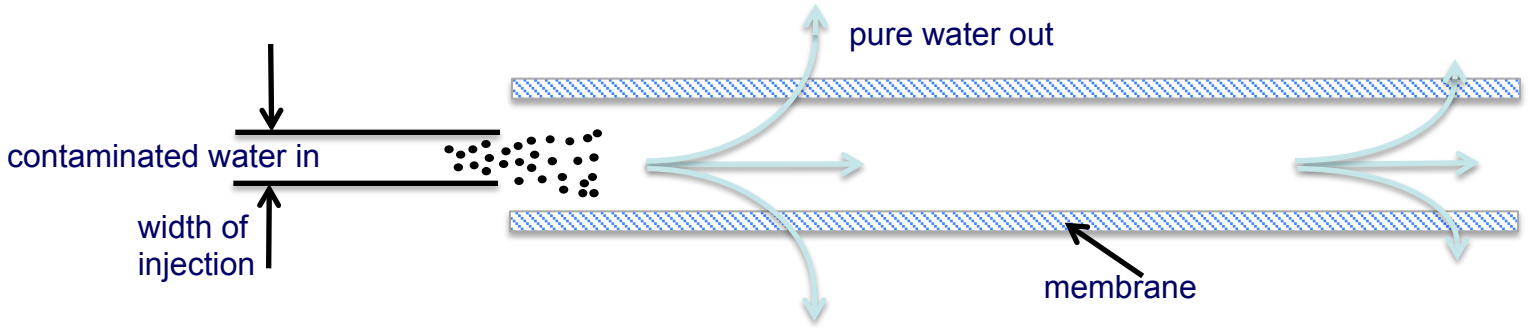
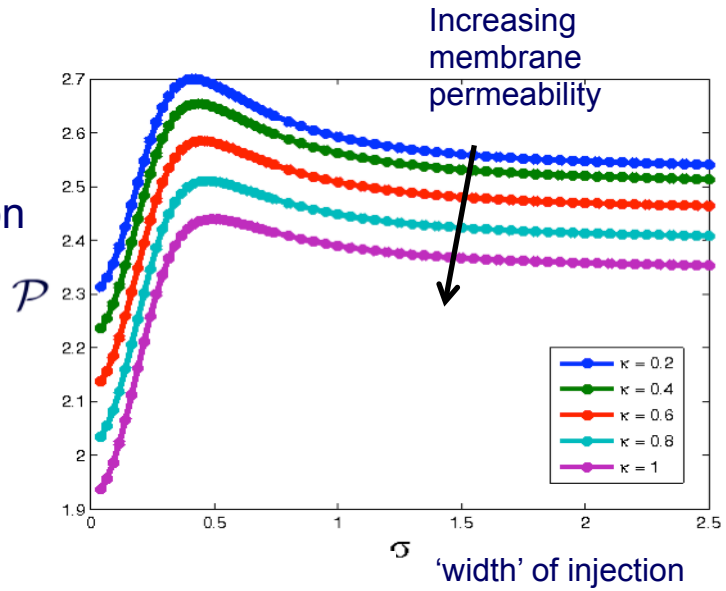


Addition of contaminants raises the viscosity of the fluid and thus the energy required to filter the water.

- To minimize energy is it better to inject as a thin stream or a wide stream?
- Actually there is a worst possible configuration when the contaminants are injected in a stream with width somewhere in between.
- These results provide guidance into optimal filtration strategies for energy reduction.



Potential projects

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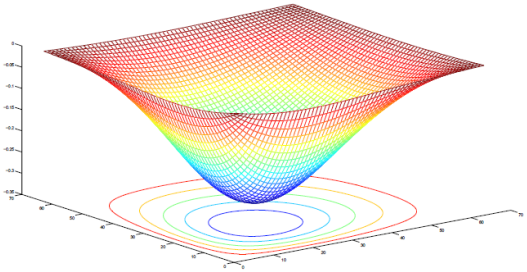

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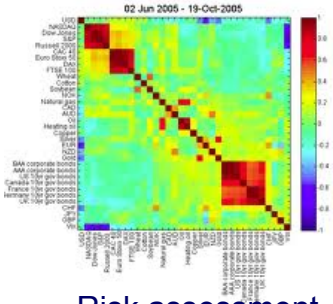

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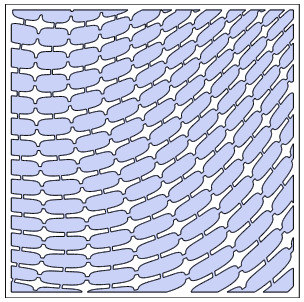

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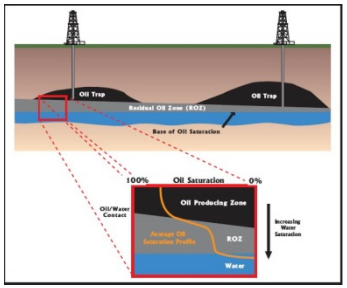

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Tear Films

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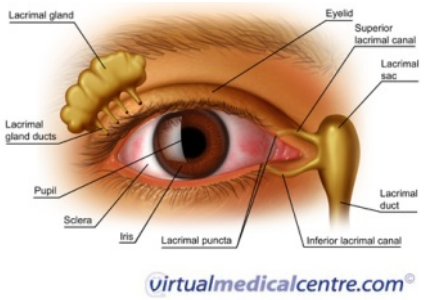

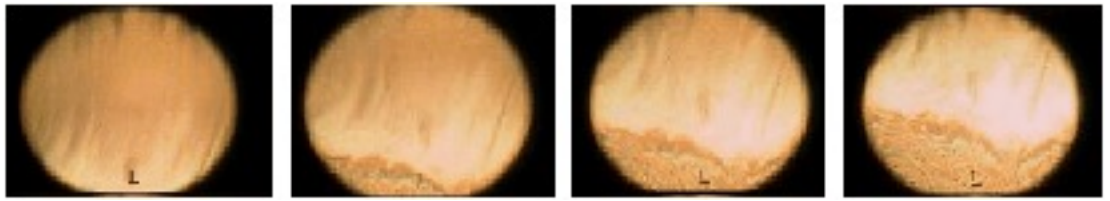

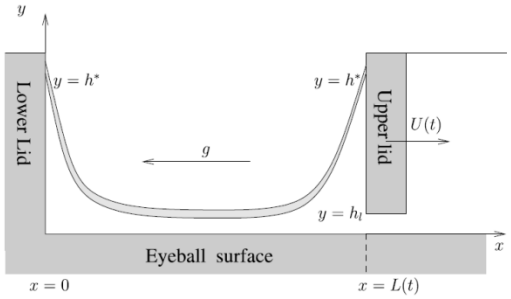

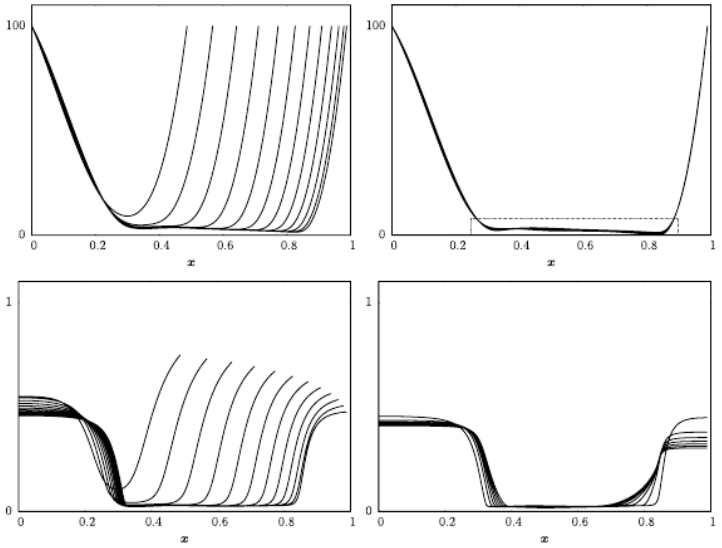

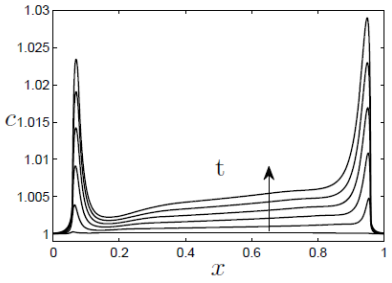

What are we looking for?

- You should have, or expect to have, a top degree in mathematics (we accept applications from people with strong 2:1s but NB last year we had 77 applicants for 11 places and everyone we took had a first, or an MSc, or overseas equivalent)
- You should be self motivated with good interpersonal skills and want to work in an interdisciplinary and interactive environment
- Our admissions criteria are:
  - Academic excellence
  - Intellectual curiosity
  - Communication ability (all CDT students will be expected to have business level English)
  - Motivation

How to apply

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Closing dates:

- 08 January
- 23 January **Important deadline for overseas applicants**
- 19 February
- 13 March

On application form:

- Programme code: "004013" (DPhil in Industrially Focused Mathematical Modelling (EPSRC Centre for Doctoral Training))
- College Choice: I have no College Preference
- Proposed field and title of research project: Put “InFoMM”
- Don’t worry about listing funding – we will automatically consider CDT applicants for the CDT funding

Our website http://www.maths.ox.ac.uk/infomm has more up-to-date information than the University’s GAF website

Any questions