

Continuum mechanics

Continuum Mechanics research in Birmingham covers several broad areas with the main emphasis on the following research directions:

- Nonlinear wave dynamics of thin films and flows on flexible substrates
- Nonlinear dynamics of bubbles and drops
- Dynamic wetting phenomena and flows over chemically-patterned surfaces
- Nonlinear flow dynamics in microchannels
- Formation of singularities in convergent free-surface flows
- Fluid flows with transitions in the topology of the flow domains
- Wetting fronts in porous media and flow dynamics on porous substrates
- Mass and heat transfer in chemical engineering
- Hypersonic boundary layers on porous and compliant walls
- Nonlinear instabilities of boundary layers and curved compressible wakes
- Optimization of fuel cells
- Dissolved air flotation and convective fluid flows
- Bifurcation theory, attractors and surface turbulence
- Homoclinic and heteroclinic trajectories in dynamical systems generated by the Navier-Stokes equations
- Computational fluid mechanics and development of problem-oriented numerical methods
- Pattern recognition and its application to fluid dynamics

The research interests of the members of the group are given below.

Professor Yulii Shikhmurzaev

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Professor of Applied Mathematics

Fluid mechanics, free-boundary problems, capillary flows (dynamic wetting, fluid motion with transitions in the topology of the flow domain), singularities in the mathematical models of natural phenomena, two-phase flows in porous media, interaction of continuous media with electromagnetic field.

[Profile \(/staff/profiles/mathshikhmurzaev-yulii.aspx\)](/staff/profiles/mathshikhmurzaev-yulii.aspx)

Dr David Leppinen

Lecturer

Applications in industrial and applied mathematics, specializing in the use of boundary integral methods to examine the dynamics of bubbles and droplets. Other interests include asymptotic and numerical analysis of convective fluid flows, optimization of fuel cells and quantitative finance. Recognized specialist in dissolved air flotation.

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Dr Grigori Sisoiev

Lecturer

Flows of liquid films and jets, non-linear wave processes. Multiphase flows, interface phenomena. Dissipative dynamical systems, bifurcation theory. Computational hydrodynamics.

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Dr Qian Xi Wang

Lecturer

Bubble Dynamics, Marine Hydrodynamics, Ground Effects, Boundary Integral Methods, Vortex Methods, Treecode for N-Body Problems, Perturbation Methods

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Dr James Sprittles

EPSRC Postdoctoral Fellow

Mathematical modelling of a cluster of industrially relevant capillary flows. In particular, developing computational tools to simulate wetting phenomena in microfluidic devices such as inkjet printers and two-phase flow through porous media.

Collaboration links include:

- University of Cambridge
- Imperial College London
- University of Bristol
- University of Dundee
- University of Leicester

- University of South Florida (USA)
 - University of Minnesota (USA)
 - Indian Statistical Institute (Kolkata)
 - Indian Institute of Technology Madras (Chennai)
 - Moscow State University (Russia)
 - Schlumberger Cambridge Research
 - US Air Force Office of Scientific Research
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