Programme

Monday 20: Theoretical fundamentals

09:15-09:30 — *Opening Remarks & Welcome* —

Session 1: Theoretical Fundamentals

09:30-10:25 **Extensional Flows: Modelling** Prof. Benoit Scheid (Université Libre de Bruxelles)

10:25-10:35 *Mini Break*

10:35-11:30 **Extensional Flows: Linear Stability and Draw resonance** Prof. Benoit Scheid (Université Libre de Bruxelles)

11:30-12:00 ———— *Coffee Break* ————

12:00-12:55 **Fundamentals of inertial lubrication theory: Part I** Prof. Christian Ruyer-Quil (Université Savoie Mont Blanc)

12:55-13:55 ———— *Lunch Break* ————

13:55-14:50 **Fundamentals of inertial lubrication theory: Part II** Prof. Christian Ruyer-Quil (Université Savoie Mont Blanc)

14:50-15:00 *Mini Break*

15:00-15:55 **Modelling viscoplastic flows: Part I** Dr. Thomasina V. Ball (University of Warwick)

15:55-16:05 *Mini Break*

16:05-17:00 **Modelling viscoplastic flows: Part II** Dr. Thomasina V. Ball (University of Warwick)

17:00 — *Welcome Reception & Poster Session* —

Tuesday 21: Numerical and Experimental investigations

Session 2: Numerical Investigations

09:30-10:25 **Modelling Thin Film Flows with Environmental Heterogeneities in Basilisk: Part I** Dr. Vrionis Panayiotis-Yiannis (The Cyprus Institute)

10:25-10:35 *Mini Break*

10:35-11:30 **Modelling Thin Film Flows with Environmental Heterogeneities in Basilisk: Part II** Dr. Vrionis Panayiotis-Yiannis (The Cyprus Institute)

11:30-12:00 ———— *Coffee Break* ————

12:00-12:55 **How to Make Your Work Attractive: What If You Are the Next Winner of the Gallery of Fluid Motion?** Dr. Lyes Kahouadji (Imperial College London)

12:55-13:55 ———— *Lunch Break* ————

13:55-14:50 **Communicating your work to (and finding) non-academic audiences** Dr. Kat Phillips / InRA Community (University of Warwick)

14:50-15:00 *Mini Break*

Session 3: Experimental Investigations

15:00-15:55 **Handling microfluidic experiments with imaging, flow measurements and external fields: Part I** Prof. Guntars Kitenbergs (University of Latvia)

15:55-16:05 *Mini Break*

16:05-17:00 **Handling microfluidic experiments with imaging, flow measurements and external fields: Part II** Prof. Guntars Kitenbergs (University of Latvia)

17:00 —— *Coffee Break & Poster Session* ——

Abstracts

Modelling of extensional flows and draw resonance

Prof. Benoit Scheid
(Université Libre de Bruxelles)

This course introduces the fibre drawing and film casting processes, where an instability referred to as draw resonance can be observed. In a first part, the framework in which models of reduced dimensionality can be obtained is presented for both the two-dimensional fiber drawing and the axisymmetric film casting configurations. The main assumptions are first introduced, followed by all steps necessary to derive the one-dimensional fiber and film models, starting from the two-dimensional mass and momentum conservation equations for isothermal and Newtonian fluids. The key feature is the use of an asymptotic expansion of the field variables based on the smallness of the aspect ratio of fibers and films. In a second part the linear stability analysis is introduced for the particular configuration of infinite-width film casting and in the purely viscous case. Note that this configuration is identical to the fiber drawing one with neglecting surface tension. Next we present an equivalent formulation that includes the normal stress difference as additional dependent variable. This alternative formulation offers a more general framework for the extension of the purely viscous case to incorporate all additional effects such as gravity, inertia, surface tension (for fiber drawing), neck-in (for film casting), viscoelasticity, and non-isothermal effects that can be considered in this framework. The last part gives more insights on the physical mechanism of the draw resonance instability and presents alternative criteria for the critical draw ratio based on kinetic wave theory.

Reference: Bechert M. & Scheid B., Draw Resonance, Fluid Mechanics and Its Applications 990 – Springer Nature Switzerland (2025)

Fundamentals of inertial lubrication theory

Prof. Christian Ruyer-Quil
(Université Savoie Mont Blanc)

This lecture will review the basics of the modelling of liquid film within the lubrication theory, including inertia: boundary-layer equations, Benney expansion (surface equations), integral boundary layer (IBL) approach, weighted residual integral boundary layer approach (WRIBL), centre manifold analysis (CMA). The Kapitza instability onset and the formation of solitary waves will be explored using the two-wave Whitham hierarchy framework and the tools of dynamical systems.

Modelling viscoplastic flows

Dr. Thomasina Ball
(University of Warwick)

Non-Newtonian flows are prevalent in industrial, geophysical and biological processes. However, understanding their behaviour remains challenging due to nonlinearities in constitutive laws and the presence of yield surfaces. In this session, we will focus on viscoplastic fluids, materials that exhibit solid- and fluid-like behaviour, in the context of two classical problems: thin films and bubble migration.

Modelling Thin Film Flows with Environmental Heterogeneities in Basilisk

Dr. Panayiotis Yiannis Vrionis
(The Cyprus Institute)

This hands-on training session introduces participants to Basilisk, a free, open-source computational framework for solving partial differential equations on adaptive Cartesian meshes. Through a series of exercises, attendees will write their first Basilisk program from scratch, learn the main Basilisk-specific classes and progress to solving the diffusion equation using Basilisk's built-in multigrid solver. This will lay the foundation for the thin-film flow solver presented at the second part, which develops a generalized biharmonic solver to handle the fourth-order equations of lubrication theory for modelling droplet transport in heterogeneous environments, i.e. under the influence of external forcing/gravity, thermal effects, or on rough substrates. The training assumes no prior Basilisk experience and is aimed at researchers who wish to use the framework in their own work.

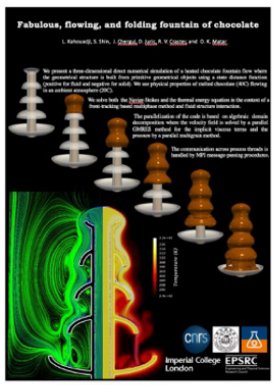
To participate in the hands-on exercises, please ensure you have the Basilisk library installed on your machine. You can find the setup guide at this [LINK]:

How to Make Your Work Attractive: What If You Are the Next Winner of the Gallery of Fluid Motion?

Dr. Lyes Kahouadji
(Imperial College London)

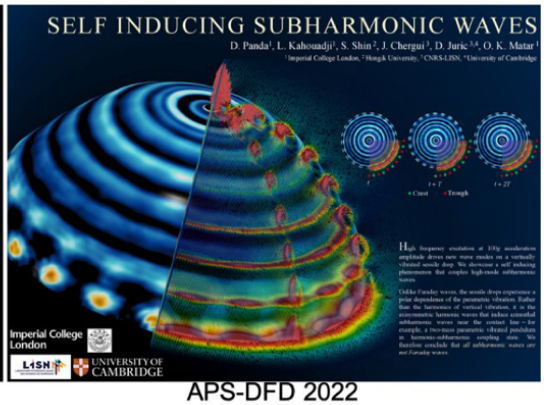
There is something inherently captivating about fluid dynamics: it resides in the elegance of motion and in the way mathematics renders that motion almost artistic. Consider the Kelvin–Helmholtz instability, whose signature wave-like cloud formations reappear each year in striking images. Or the remarkable hexagonal storm at the north pole of Saturn, and the delicate, repeating patterns generated by the Faraday instability. Whether in articles, seminars, or conferences, the presentation of such phenomena demands equal care. Clarity and aesthetic appeal should go hand in hand: fewer elements, thoughtfully chosen, can convey a greater depth of insight and understanding. My colleagues and I have participated in numerous editions of the Gallery of Fluid Motion at the APS Division of Fluid Dynamics Annual Meeting, where our work has been recognised with two Milton Van Dyke Awards and three Gallery of Fluid Motion Awards. In this talk, I will present these contributions and share the story behind these achievements.

Despite my current supervisor jokingly warning, "don't give away all your secrets!", I will offer practical insights and guidance on how to present your work in a compelling and visually engaging way.



UK Fluid-Network Video Award (2019)

APS-DFD 2019 Milton Van Dyke Award



APS-DFD 2022 GFM Award

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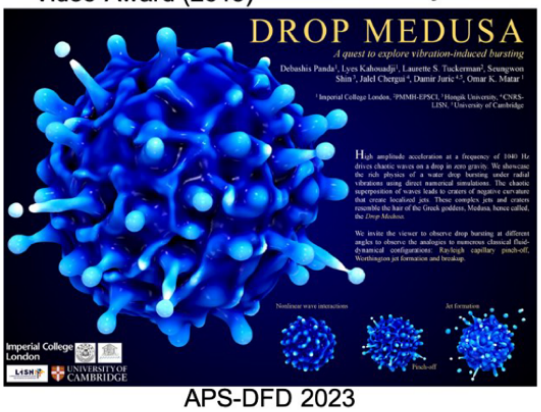
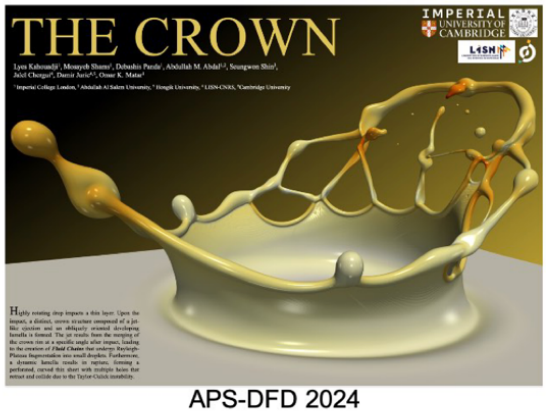


APS-DFD 2023 Milton Van Dyke Award



APS-DFD 2024 GFM Award

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Communicating your work to (and finding) non-academic audiences with non-academic audiences

Dr. Kat Phillips
InRA Community (University of Warwick)

This hour-long interactive workshop will introduce you to the key concepts required to communicate your mathematics effectively. In particular, we will be focusing on how to define and adapt to your audience, whether that is other mathematicians, non-subject experts, policymakers or 'the general public'.

Handling microfluidic experiments with imaging, flow measurements and external fields

Prof. Guntars Kitenbergs
(University of Latvia)

Combining microfluidic experiments with microscope, flow measurement and field generation systems can be challenging. I will share some tips and tricks on setting up and performing experiments and subsequent data analysis with custom built microscope systems that include microfluidic devices, experiment synchronization and image processing. I will also discuss some peculiarities when working with magnetic systems and flow measurement techniques like Particle Image Velocimetry (PIV).