Programme of the Burgers Symposium 2023

31st May and 1st June 2023, Hotel De Werelt in Lunteren

J.M. Burgerscentrum

Research School for Fluid Mechanics

Organizing Committee
Chair: Ruud Henkes
Support: Corine Zoutendijk (jmburgerscentrum@tudelft.nl)
Members: Alvaro Marin, Daniel Tam, Dominik Krug, Hanneke Gelderblom, Marjolein van der Linden, Tim Peeters, Valeria Garbin, Woutijn Baars, Yali Tang

2023 Burgers Lecture by Prof. Peko Hosoi

"Filtration and fundamental fluid mechanics inspired by the manta ray"

Anette "Peko" Hosoi is the Neil and Jane Pappalardo Professor of Mechanical Engineering with appointments in the Institute for Data, Systems, and Society (IDSS) and Mathematics at MIT. Prof. Hosoi's research interests include fluid dynamics, bio-inspired design, sports data and technology, and optimization of biological systems with applications to the emergent field of soft robotics. She is the co-founder of the MIT Sports Lab. She received an AB in physics from Princeton University, and an MA and PhD in physics from the University of Chicago.

Abstract of lecture. Heating, ventilation, and air conditioning (HVAC) systems account for about 20% of energy consumption in the US of which at least 7% is consumed by fans. In addition, approximately 4% of US energy is consumed by the production, treatment, and distribution of water. A key component of the efficiency in all of these systems is the performance of filters in which reducing resistance can result in significant energy savings. In this talk, we will explore novel strategies for filtration inspired by the manta ray which has evolved a system for filtering zooplankton that appears to be unlike any filtration mechanism previously observed in biological or industrial settings. Rather than adopting a sieve strategy, the manta deploys microstructures which are hypothesized to instigate eddies that push particles away from the filtration pores, resisting clogging, and enabling the filtration of particles much smaller than the pore size.

The lecture will examine two toy problems that mimic various features of the filtration strategies employed by manta rays. In the first, the effect of microstructures in a "leaky pipe" is examined. In the second the mechanisms that enable particles to cross streamlines are discussed, which is an essential feature in separating flows into particle-rich and particle-free streams. In particular, it is known that inertial lift forces can lead to particle focusing in channel flows; yet oscillatory straining effects have also been suggested as a mechanism for particle focusing in wavy channels. To determine which of these two mechanisms dominate, the particle-free channel flow is decomposed into a primary Poiseuille flow and secondary eddies induced by the waviness. A calculation is made for the perturbation of the particle on the particle-free flow and the resulting lateral lift force exerted on the particle using matched asymptotics. The interaction between the zeroth-order lift force and the particle-free flow largely determines the focusing locations. It is found that experimental data from wavy channels are consistent with the asymptotic predictions of the focusing locations, which are primarily governed by the channel Reynolds number, the particle size, and the amplitude of the waviness.

Evening Lecture by Prof. Erik van Sebille

" Tackling the plastic soup: How physicists, mathematicians and computer scientists can support a clean and sustainable ocean"

Erik van Sebille is Professor in Oceanography and Public Engagement at the Institute of Marine and Atmospheric (IMAU) at Utrecht University. He is interested in how oceans move plastic and organisms around, and how currents connect the different ocean basins. He builds computer models to simulate the transport of 'stuff' in the ocean. He received his PhD in physical oceanography in 2009 from Utrecht University.

Abstract of lecture. Large amounts of plastic waste float in the ocean. That plastic harms marine life. But where does that plastic come from? What happens to the plastic when it's in the ocean? And can we clean it up? By modelling the ocean circulation and how it transports plastic, we try to answer these questions. We use techniques from mathematics, computer science and information science to better understand the physics of ocean currents. And with that understanding, we can make the world a little more sustainable.

KIVI Hoogendoorn Fluid Mechanics Award for dr. ir. Willian Hogendoorn

Willian Hogendoorn defended his PhD thesis (with Cum Laude distinction) on 15th December 2021 at Delft University of Technology, with promotors prof. dr. ir. C. Poelma and dr. ir. W.P. Breugem. The thesis is entitled: "Suspension dynamics in transitional pipe flow". Measurements were performed using state-of-the-art measurement techniques, which provide insight in particle-laden flows. These measurement techniques include ultrasound, magnetic resonance and optical imaging. The high-quality data, obtained using these measurement modalities, have subsequently been used for the modelling of suspension flows.. The prize will be awarded at the Symposium, where the winner will also give a presentation on his thesis work.

Wednesday 31st May 2023

09:30 – 10:30 Registration with coffee/tea

10:30 – 10:40 Opening in Room "Earth"

Hans van Duijn – Opening by the Chairman of Board of the Burgerscentrum

Ruud Henkes – Welcome by the Scientific Director of the Burgerscentrum

10:40 – 11:30 Burgers Lecture in Room "Earth"

Prof. Peko Hosoi (MIT, USA) – The 2023 Burgers Lecture "Filtration and fundamental fluid mechanics inspired by the manta ray"

11:30 – 11:50 Flow to the Future (Room "Earth")

Detlef Lohse – Fluid Dynamics in the Netherlands

11:50 – 12:30 Fluid Flow in Industry (Room "Earth") (Chair: Marjolein van der Linden)

Jasper Kreeft (Shell): Multi-fidelity flow modeling for offshore wind energy yield assessments

Maaike Rump (Canon): Droplet formation in inkjet printing

Tim Peeters (Tata Steel): Fluid Mechanics challenges for Tata Steel's transition to hydrogen-based steelmaking

12:30 – 13:30 Lunch

13:30 – 14:30 Parallel Sessions

Room "Earth" – Environmental Flow (Chair: Ton van den Bremer)

Jeancarlo Manuel Fajardo Urbina (TU/e – Fluids and Flows – Matias Duran Matute): Forecast of particle spreading using machine learning in a complex multiple-inlet coastal system

Andres Yarce Botero (TUD – Mathematical Physics – Arnold Heemink): Estimating wind and emission parameters in an atmospheric transport model

Chit Yan Toe (TUD – Environmental Fluid Dynamics – Davide Wuthrich): Carpet formation due to accumulation of floating plastic debris at hydraulic structures

Luyang Kang (TU/e – Building Physics – Twan van Hooff): Influence of air supply location on the air distribution performance in a vertical farm

Pim Waasdorp (UT – Physics of Fluids – Sander Huisman): Self-sculpting of melting oil in water

Room "Air" – Reactive Flow (Chair: Valeria Garbin)

Akmal Irfan Majid (TU/e – Power and Flow – Yali Tang): Regenerating iron via electrolysis for CO_2-free energy storage and carrier

Jan-Willem Hurkmans (TUD – Transport Phenomena – David Vermaas): Heat transfer in alkaline water electrolysis

Faeze Khalighi (TU/e – Power and Flow – Bert Vreman): Effects of the boundary conditions at the gas-liquid interface on single hydrogen bubble growth in alkaline water electrolysis

Aleksandr Bashkatov (UT – Physics of Fluids – Dominik Krug): Coalescence governed dynamics of hydrogen bubbles during water electrolysis

Aravind Ravi (TU/e – Power and Flow – Jeroen van Oijen): Effect of particle size distribution on the laminar flame speed of iron aerosols

14:40 – 15:30 Parallel Sessions

Room "Earth" – Wall-Bounded Flows (Chair: Dominik Krug)

Lina Nikolaidou (TUD – Multiphase Systems – Tom van Terwisga): Effect of incoming flow conditions on regime transitions in air lubrication

Chris Howland (UT – Physics of Fluids – Detlef Lohse): Turbulent mixed convection in vertical channels

Pietro Carlo Boldini (TUD – Energy Technology & Thermal Fluids Engineering – Jurriaan Peeters): Direct numerical simulation of H-type transition in a flat-plate boundary layer with supercritical fluids

Babak Mohammadikalakoo (TUD – Aerodynamics – Marios Kotsonis): Metaheuristic optimisation for active suppression of Tollmien-Schlichting waves

Room "Air" – Computational Methods (Chair: Kartik Jain)

Stein Stoter (TU/e – Power and Flow – Hans Kuerten): Characterizing scale interaction for discontinuous Galerkin methods with the variational multiscale method

Sanne van Essen (TUD – Ship Hydromechanics – Harleigh Seyffert): Finding dangerous waves - Prediction of wave impact design loads on maritime structures

Peng Qin (TU/e – Building Physics – Bert Blocken): CFD simulations of pollutant dispersion in a street canyon: impact of idealized and realistic sources

Tristan Vlogman (UT – Engineering Fluid Dynamics – Kartik Jain): Effect of injection parameters on the mixing of particles injected from a catheter using a coupled Lattice Boltzmann and Discrete Element Method.

15:30 – 16:00 Coffee / Tea

16:00 – 16:30 One-minute pitches in Room "Earth" (Chair: Hanneke Gelderblom & Alvaro Marin)

16:30 – 17:30 Poster Session in Room "Fire"

17:30 – 18:30 Drinks in Room "Fire"

18:30 – 20:15 Symposium Dinner

20:30 – 21:30 Symposium Address and Evening Lecture (Chair: Ruud Henkes)

Prof. Erik van Sebille (Utrecht University) - Tackling the plastic soup: How physicists, mathematicians and computer scientists can support a clean and sustainable ocean

21:30 End first symposium day

Thursday 1ˢᵗ June 2023

09:00 – 10:30 Plenary Session in Room "Earth"

Presentations by New Staff Members (Chair: Yali Tang)

Ton van den Bremer (TUD - Environmental Fluid Mechanics): The fluid mechanics of ocean waves

Giulia Finotello (TU/e – Power & Flow): Metal atomization and particle processing

Kartik Jain (UT - Engineering Fluid Dynamics): Computational modeling of cerebrospinal fluid flow

Uddalok Sen (WUR - Physical Chemistry and Soft Matter): Salt-rimmed capillaries: is it creep (or is it a weirdo)?

Morgan Li (TUD – Aerodynamics): Turbulent flows with added complexity: wall roughness, droplets and more

Maziyar Jalaal (UvA – Soft Matter Group): On fluid mechanics of 3D printing

10:30 – 11:00 Coffee / Tea

11:00 – 11:50 Parallel Sessions

Room "Earth" – Aerodynamics & Turbulence (Chair: Woutijn Baars)

Jesse Reijtenbach (TUD – Fluid Mechanics – Mark Tummers): An improved drag prediction method for accelerated objects

Jens Kasper (UT – Physics of Fluids – Richard Stevens): The impact of baroclinicity on wind farm performance and wind farm wakes

Adrian Grille Guerra (TUD – Aerodynamics – Fulvio Scarano): On the scalability of helium-filled soap bubbles

Hasse Dekker (TUD – Wind Energy – Woutijn Baars): Unsteady flow behaviour of multi-rotors in ground proximity

Room "Air" – Multiphase Flow (Chair: Giulia Finotello)

Noah Romijn (TU/e – Multi-Scale Modelling of Multi-Phase Flows – Maike Baltussen): A comparison of hydrodynamics and structure in a random packed bed with cylindrical particles

Heng Li (TUD – Complex Fluid Processing – Lorenzo Botto): Stokesian dynamics investigation of sedimentation of a polydisperse suspension: towards size fractionation by centrifugation

Yavuz Emre Kamis (TUD – Multiphase Systems – Wim-Paul Breugem): Controlling the breakup of spiralling jets

Wouter Peerbooms (TUD – Multiphase Systems – Antoine van der Heijden): Influence of solid friction on the rheology of dense suspensions in plane Couette flow

12:00 – 12:35 Parallel Sessions

Room "Earth" – Biological Flows (Chair: Morgan Li)

Twan Wilting (TU/e – Fluids and Flows – Hanneke Gelderblom): Collective motion of E. coli bacteria at the contact line of an evaporating drop

Yuri Sinzato (UVA – Soft Matter Group – Mazi Jalaal): Dynamics of cyanobacterial colonies under turbulent shear flows

Bob Mulder (TUD – Fluid Mechanics – Daniel Tam): Emerging synchronization in a coupled network of ciliated micro-organisms

Room "Air" – Complex Fluids (Chair: Udo Sen)

Antoine Gaillard (UVA Soft Matter Group – Daniel Bonn): Breakdown of universality in viscoelastic pinch-off

Alexandros Oratis (UT – Physics of Fluids – Jacco Snoeijer): Bubble coalescence in viscoelastic liquids

Hugo Leonardo França (UVA Soft Matter Group – Mazi Jalaal): Spreading of elastoviscoplastic droplets

12:35 – 13:30   Lunch

13:30 – 15:00 Parallel Sessions

Room "Earth" – Microfluidics (Chair: Daniel Tam)

Jelle Schoppink (UT – Mesoscale Chemical Systems – David Fernandez Rivas): Cavitation induced by pulsed and continuous-wave lasers in confinement

Nagaraj Nagalingam (TUD – Complex Fluid Processing – Burak Eral): Unified framework for laser-induced transient bubble dynamics within microchannels

Burak Akdeniz (UT – Soft Matter, Fluidics, and Interfaces – Jeff Wood): Use of polyelectrolyte coating to achieve constant zeta potential and diffusiophoretic behaviour

Ankur Deep Bordoloi (TUD – Product and Process Eng. – Pouyan Boukany): Transport of particles in complex microsystems: from colloids, bacteria to cancer cells

Muhammad Ahmed Hanif (UT – Physics of Fluids – Devaraj van der Meer): Flow dynamics of different particle shapes in a quasi 2D silo

Leila Hashemi (TUD – Numerical Analysis – Kees Vuik): Pore-scale simulation of hydrogen transport in porous media

Weiran Zhang (TUE – Chemical Process Intensification – Ivo Roghair): Numerical simulation of microdroplets coalescence behaviors on a single microscale fiber

Room "Air" – Droplets & Bubbles (Chair: Mazi Jalaal)

Kaili Xie (UVA – Soft Matter Group – Daniel Bonn): Early stages of drop coalescence

Pim Dekker (UT – Physics of Fluids – Marjolein van der Linden): Evaporation of one and more multi-component drops

Bernardo Palacios Muniz (UT – Physics of Fluids – Devaraj van der Meer): Impact of boiling liquids: droplets on surfaces

Jochem Meijer (UT Physics of Fluids – Detlef Lohse): Topological transition of a double-emulsion droplet during its cryopreservation

Jan Siemen Smink (UT – Engineering Fluid Dynamics – Claas Willem Visser): Design and production of microfibers using in-air photopolymerization for the use in particle-laden turbulence

Antoine Parrenin (UVA – Soft Matter Group – Daniel Bonn): How does a spray cloud behave?

Dennis Thuy (TU/e – Power and Flow – Giulia Finotello): Large eddy simulations of primary breakup in metal melt gas atomization

15:10 – 15:40   Plenary Closure Session in Room "Earth" (Chair: Ruud Henkes)

- **2022 KIVI Hoogendoorn Fluid Mechanics Award (Laudatio & Presentation)**
- **2 Young Scientist Awards for Best Oral Presentation**
- **Burgers Gallery Award for Best Poster**
- **Burgers Gallery Award for Best Movie**

15:40 hr End of Burgers Symposium 2023

Burgers Gallery

(31st May and 1st June in Room "Fire")

Movies:

Dennis Thuy (TU/e – Power and Flow): Large eddy simulations of primary breakup in metal melt gas atomization

Jesse Hofsteenge (UT – Thermal Engineering): Numerical analysis of swirl variation effect on cyclone burner flame transfer function

Haris Shahzad (TUD – Aerodynamics): Turbulent boundary layer over acoustic liners

Muhammad Saeed Saleem (UT – Physics of Fluids): Microcapsules production with an additively manufactured 3D microfluidic channel for applications in intumescent coatings

Peng Qin (TU/e – Building Physics): CFD simulations of pollutant dispersion in a street canyon: impact of idealized and realistic sources

Timo van Overveld (TU/e – Fluids and Flows): Dynamic patterns of spheres in an oscillating flow

Udo Sen (WUR – Physical Chemistry and Soft Matter): A droplet devouring its jet

Xander de Wit (TU/e – Fluids and Flows): Bistability of the large scale dynamics in quasi-two-dimensional turbulence

Posters:

Ali Rezaei (UT – Physics of Fluids): Acoustic cavitation of microbubbles in tubes

Alireza Ghasemi (UT – Thermal Engineering): Analyzing a swirl stabilized airblast burner using dynamic mode decomposition

Anab Ghosh (TU/e – Fluids and Flows): Numerical simulations of liquid jetting with solid inclusions

Ata Onur Baskaya (TUD – Aerodynamics): Influence of ablation on atmospheric entry aerothermodynamics

Austin Labuschagne (UT – Thermal Engineering): Lost in frost: a micro-CT investigation

Berksu Erkal (UT – Thermal Engineering): One dimensional modelling of cyclone burner

Calum Thomas Ryan (TU/e – Fluids and Flows): The effect of electrolytic-like processes during water plasma impingement on the induced liquid flow

Cayan Demirkir (UT – Physics of Fluids): Detachment characteristics of hydrogen bubbles in water electrolysis

Cem Bingol (TU/e – Fluids and Flows): Effect of oscillatory forcing on mixing, front position and lifting of gravity currents

Chang Wang (RUG – Computational Mechanical and Materials Engineering): Vortex induced vibrations of marine risers: validating turbulence models

Dario Passato (TU/e – Power and Flow): Transfer matrix estimation for network models with fluid structure interactions

Davide Selvatici (UT – Physics of Fluids): Effectively capturing wind turbines loading with an advanced Actuator Line Model

Dayo Jansen (WUR – Experimental Zoology): Studying auditory-induced escape manoeuvres and flight activity of pest moths to create novel bio-inspired pest-control solutions in greenhouses

Duco van Buuren (UT – Physics of Fluids): Construction and characteristics of a large scale jet grid for the Twente Water Tunnel

Farzan Sepahi (UT – Physics of Fluids): Competing solutal and thermal Marangoni effects near electrolytically-generated gas bubbles

Gijs Wensink (TU/e – Energy Technology): Dynamics of water films during wetting and drying cycles in porous media

Giulio Ortali (TU/e – Fluids and Flows): Learning a Lattice Boltzmann collisional operator

Guanxing Kuang (UT - Thermal Engineering): 3D Printing of silver nanoparticles embedded foams with direct bubble writing for pressure sensor applications

Guru Sreevanshu Yerragolam (UT – Physics of Fluids): Effect of airflow rate on CO_2 concentration in downflow indoor ventilation

Ilambharathi Govindasamy (WUR – Experimental Zoology): On the effect of flow separation in added mass and its relevance to Diptera flight

Jesse Hofsteenge (UT – Thermal Engineering): Numerical analysis of swirl variation effect on cyclone burner flame transfer function

Julie Jagielka (UVA – Soft Matter Group): Why do dishes become slippery when you use dishwashing liquid for cleaning them?

Kasra Farain (UVA – Soft Matter Group): Quantitative understanding of the onset of granular flows

Lenin Moisés Flores Ramírez (TU/e - Fluids and Flows): Effects of secondary motions in the horizontal dispersion of particles within shallow flows

Liangyuan Wei (TU/e – Chemical Process Intensification): Simulation of fluid dynamics under induction heating

Luuk Groot Koerkamp (UT - Engineering Fluid Dynamics): Attached vortical structures on the wing of a Robotic Falcon

Marko Draškić (TUD – Energy Technology & Thermal Fluids Engineering): SCO2PE: Experiments on the natural circulation, transition and heat transfer of supercritical CO_2.

Nico Schramma (UVA – Soft Matter Group): Glowing with the flow – mechanically stimulated bioluminescent algae as living stress sensors

Prasansha Rastogi (UT – Engineering Fluid Dynamics): Direct bubble writing of gradient architecture foams for acoustic insulation

Rahman Sabahi Kaviani (TU/e – Microsystems): Nervous system-on-chip for Parkinson's disease

Rens Stigter (TUD – Ship Hydromechanics): The effect of water impurities on Interferometric Particle Imaging

Robin Klein (TUD – Fluid Mechanics): Stable kinetic energy conserving discrete empirical interpolation for ROMs of the incompressible Navier-Stokes equations

Rui Yang (UT – Physics of Fluids): Shape effect of ice melting in flow

Sajjad Karimnejad (TU/e - Fluids and Flows): Transient deformation and swelling of paper by aqueous co-solvent solutions

Shravan Raaghav (TU/e – Fluids and Flows): Bubble curtains for salt intrusion mitigation in lock-exchange flows with and without stratification

Shuo Wang (TU/e - Fluids and Flows): Transport and evaporation of aqueous co-solvent mixtures in thin porous media

Sowmya Kumar (TUD – Fluid Mechanics): Shear rheology of algae suspensions

Stefano Onofri (UT – Multiscale Mechanics): Numerical simulations of liquid bridges between colloids

Suriya Prakash (TUD – Complex Fluid Processing): Controlled buckling of evaporating suspension drops with 2D nanomaterials

Thijs Varkevisser (UVA – Soft Matter Group): The effect of polymers on the retraction of impacting droplets

Tim Kousenmaker (RUG – Computational Mechanical and Materials Engineering): Numerical Investigation of supercritical CO_2 injection in twin screw extruders using the Level Set Method.

Timo van Overveld (TU/e – Fluids and Flows): Self-organization of spherical particles submerged in an oscillating flow

Tom Appleford (UVA – Soft Matter Group): Droplet induced shear banding in viscoplastic materials

Vatsal Sanjay (UT – Physics of Fluids): How the electrolyte enters electrolytically generated bubbles: through Worthington jets

Vincent Siekman (UT – Physics of Complex Fluids): Advanced grease lubrication based on liquid-infused surfaces

Wencan Wu (TUD – Aerodynamics): Passive control of shock-wave/turbulent boundary-layer interaction using spanwise heterogeneous roughness

Xander de Wit (TU/e – Fluids and Flows): Shaping turbulence with smart particles

Xiaoxing Li (TU/e – Power and Flow): Evaporation of inkjet-printed droplets laden with surfactants on unsaturated porous media

Yang Liu (UT – Physics of Fluids): Modeling mesoscale wind speed variations in large eddy simulations of wind farms

Yiwei Long (UT – Engineering Fluid Dynamics): Fabrication of core-shell hydrogel particles via In-air microfluidics for CO_2 capture

Yixin Zhang (UT – Physics of Fluids): Maximum current for stable electrolytic nanobubbles

Yuedi Bai (UT – Engineering Fluid Dynamics): Wind tunnel validation of vortex generator influence on 30% thickness airfoil upon low Reynolds number

Jury two best junior oral presentations:

Emma Hinderink – Peter Veenstra – Willem van de Water – Edwin Poorte

Jury best poster and best movie:

Tsz Kin Timothy Chan – Hanneke Gelderblom – Peko Hosoi – Alvaro Marin – Daniel Tam