2021

BURGERS SYMPOSIUM

Online

26 & 27 MAY 2021

The Burgers Symposium is a two-days meeting of the JM Burgers Centre (JMBC), and it usually forms the annual meeting platform for all (junior and senior) scientists of the JMBC. Due to the COVID-19 pandemic, the Burgers Symposium 2021 will be organised in an online format, with only plenary presentations.

The Symposium is held on the afternoons of Wednesday 26 May and Thursday 27 May 2021.

http://www.jmburgerscentrum.nl

J.M.Burgerscentrum

Research School for Fluid Mechanics

- Burgers Lecture by prof. Howard Stone, Princeton University (USA)

- Plenary lectures by
  prof. Anne Juel (University of Manchester, UK)
  prof. Wolfgang Schröder (RWTH Aachen, D)
  prof. Matthew Juniper (University of Cambridge, UK)
  prof. Jacques Magnaudet (IMFT Toulouse, F)

- Award session of prizes:
  Charles Hoogendoorn Fluid Dynamics Award 2019 (KIVI) by dr.ir. Cees Voesenek (WUR)
  Charles Hoogendoorn Fluid Dynamics Award 2020 (KIVI) by dr.ir. Anouk Bomers (UT)
  Leen van Wijngaarden Prize 2020 by dr.ir. Florian Muijres (WUR)

- Registration
  Click on the interactive link to go to the registration page –› www.jmburgerscentrum.nl

WEDNESDAY 26 MAY GENERAL PROGRAMME

Opening	13.30 – 13.40	GertJan van Heijst (Scientific Director) and Hans van Duijn (Chairman JMBC Board)
Burgers Lecture	13.40 – 14.25	Howard Stone (Princeton, USA) (Some of) the challenges and beauty of fluid mechanics
Plenary Lectures	14.30 – 15.15	Matthew Juniper (Cambridge, UK) Data assimilation and Machine Learning in thermoacoustics
	15.20 – 16.05	Wolfgang Schröder (RWTH Aachen, D) Wavy drag reduction works!

THURSDAY 27 MAY GENERAL PROGRAMME

Plenary Lectures	13.30 – 14.15	Anne Juel (Manchester, UK) Life and fate of a bubble in a geometrically-perturbed Hele-Shaw channel
	14.20 – 15.05	Jacques Magnaudet (Toulouse, F) The fate of a pair of deformable rising bubbles initially released in line
Awards Session	15.10 – 15.30	Hoogendoorn Award 2019 : Cees Voesenek
	15.30 – 15.50	Hoogendoorn Award 2020 : Anouk Bomers
	15.50 – 16.20	Leen van Wijngaarden Prize 2019 : Florian Muijres
Closure		

BURGERS LECTURE

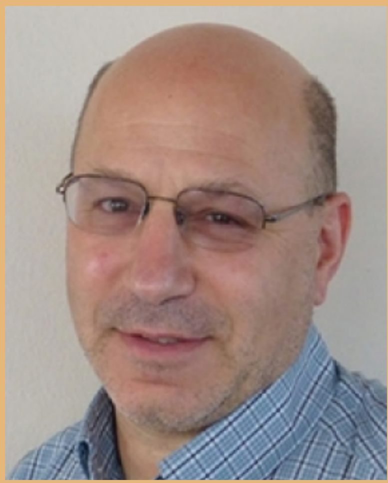
13.40-14.25

WEDNESDAY 26 MAY

PROF HOWARD STONE
PRINCETON UNIVERSITY, USA

(Some of) the challenges and beauty of fluid mechanics

Fluid mechanics has a rich history, as of course does mechanics more generally. Modern research themes introduce new questions, some of which can be understood using fundamental concepts. Just as significantly, the ideas bridge science and engineering disciplines, even as they generate new fundamental research questions in fluid mechanics. In this talk I sketch some recent themes from my research group, which bridge a wide range of length scales, including (i) problems of fluid-structure interactions at low Reynolds numbers, where the flow of a liquid and the deformation of a solid are coupled, (ii) ways in which gradients of chemical concentrations can drive the motion of small particles, highlighting the role of the difference of ion valences and background electrolyte, and in some instances making new connections to Taylor dispersion, and, if there is time, (iii) we illustrate an experimentally motivated similarity solution involving three independent variables.



14.30-15.15

WEDNESDAY 26 MAY

PROF MATTHEW JUNIPER
UNIVERSITY OF CAMBRIDGE, UK

Data assimilation and Machine Learning in thermoacoustics

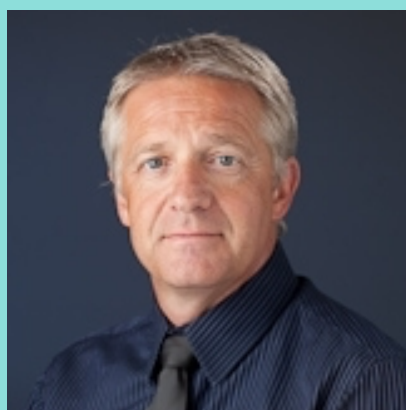
The classical scientific approach is to identify the pertinent physics of a problem, build an appropriate model, perform some appropriate analysis, and test the model experimentally. For engineering problems, this often produces a qualitatively-accurate model but rarely produces a quantitatively-accurate model. For engineers who would like to use a model to optimize the design of a system, however, the model needs to be reliable enough to be a quantitatively-accurate representation of the physics but small enough that it can produce results on a useful timescale. This talk presents methods that produce a quantitatively accurate model, illustrated by the problem of thermoacoustic instability. This is a scientific phenomenon whose physics is qualitatively well understood but for which low order models are not sufficiently accurate to be useful for design. The aim of the talk is to show how we build a quantitatively-accurate model by assimilating tens of thousands of experimental datapoints using first and second order adjoint methods applied to the model. It will show how to determine the best model, which may not be the most detailed model, and how one can combine these models with Machine Learning methods such as Gaussian Processes and Neural Networks.

15.20-16.05

WEDNESDAY 26 MAY

PROF WOLFGANG SCHRODER
RWTH AACHEN, D

Wavy drag reduction works!



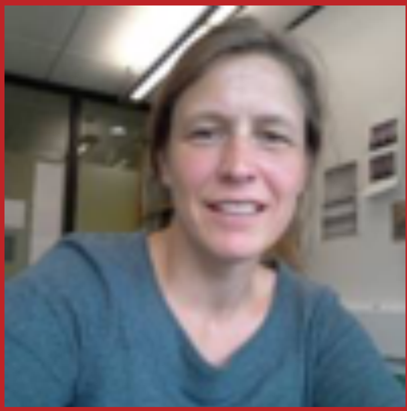
Drag reduction in turbulent boundary layers is key for substantial energy savings in aerodynamics. Large parts of the flow over the wing of modern aircraft are turbulent such that even net energy savings of a few percent lead to high cost savings. Active drag reduction methods have shown to be capable of significantly reducing the drag in generic external turbulent wall-bounded flows. First, some fundamental knowledge of the technique of spanwise traveling transversal surface waves will be developed for the flat plate turbulent boundary flow. These results will also be used to derive via machine learning a model that allows drag reduction prediction for an extended parameter range. Based on this input of these generic studies the technique of spanwise traveling transversal surface waves will be applied to two aerodynamically completely different wing sections - DRA2303 and NACA4412 - at a chord-based Reynolds number of Rec = 400,000. Several parameter combinations are tested for maximum drag reduction and maximum net power saving. The results show a reduction of the total drag of up to 8.5 percent and a decrease of the viscous drag by up to 12.9 percent. Note that this includes all actuated and non-actuated parts of the surface, i.e., locally a much higher decrease of the wall-shear stress is achieved. Additionally the lift is slightly increased and positive net power saving is obtained.

13.30-14.15

THURSDAY 27 MAY

PROF ANNE JUEL

UNIVERSITY OF MANCHESTER, UK



Life and fate of a bubble in a geometrically-perturbed Hele-Shaw channel

We study experimentally and numerically the propagation of an air bubble through a fluid-filled, geometrically-perturbed Hele-Shaw channel; a system which supports several stable modes of steady bubble propagation. During its transient evolution, a bubble may undergo several topological changes in the form of breakup and coalescence, depending on both initial conditions and control parameters. Long-term, either a single bubble is recovered or else multiple bubbles remain, whose relative separation increases with time. Despite its apparent complexity the bubbles' transient behaviour is organised by a number of weakly unstable invariant solutions of the system, so-called edge states. An unusual feature of the system is that changes in topology due to bubble break up or coalescence lead to changes in the invariant-solution structure during temporal evolution. Families of two-bubble and single-bubble invariant solutions can be related in the sense that their propagation speeds are identical, but there are two-bubble solutions that do not have single-bubble equivalents. We also explore how the bubble becomes increasingly sensitive to initial conditions and roughness of the channel and exhibits long and disordered transients as the flow rate increases. We suspect that this increase in complexity is due to a subcritical transition to disorder above a threshold that depends on the roughness of the channel, reminiscent of the transition to turbulence in shear flow.

14.20-15.05

THURSDAY 27 MAY

PROF JACQUES MAGNAUDET

IMFT TOULOUSE, F

The fate of a pair of deformable rising bubbles initially released in line

We make use of highly resolved simulations to analyse the buoyancy-driven motion of two gas bubbles released in line in a liquid at rest, focusing on regimes in which the path of an isolated bubble is vertical. We first constrain the evolution to remain axisymmetric and determine the equilibrium congurations of the bubble pair as a function of the two control parameters of the system, namely the buoyancy-to-viscous and buoyancy-to-capillary force ratios defining the Galilei (Ga) and Bond (Bo) numbers of the system, respectively. However the three-dimensional solutions reveal that this axisymmetric equilibrium is actually never reached. At the lower end of the explored (Ga, Bo)-range, the bubble pair follows a Drafting-Kissing-Tumbling scenario which eventually yields a planar side-by-side motion. For larger Ga, the trailing bubble drifts laterally and gets out of the wake of the leading bubble, barely altering the path of the latter. In this second scenario, the late conguration is characterized by a signicant inclination of the tandem. Last, when the Bond number exceeds a critical Ga-dependent threshold, the two bubbles get very close to each other and eventually coalesce. The simulations reveal that bubble deformation has a major influence on the evolution of the system. It controls the strength of the leading bubble wake, hence that of the attractive force acting on the trailing bubble. It also governs the strength and even the sign of the lateral force acting on this bubble, a mechanism of particular importance when the bubble pair is released with a small angular deviation.

15.10-15.30

CHARLES HOOGENDOORN AWARD 2019 (KIVI)

Dr.ir. Cees Voesenek (former PhD student at Wageningen University)

This KIVI prize for the best PhD thesis in fluid dynamics defended in the Netherlands in the academic year 2018 – 2019 has been awarded to dr.ir. Cees Voesenek for his PhD thesis: “How fish larvae swim - from motion to mechanics”, defended (cum laude) on 12 June 2019 (supervisors prof. Johan van Leeuwen (WUR), prof. GertJan van Heijst (TU/e) and dr. Florian Muijres (WUR).

15.30-15.50

CHARLES HOOGENDOORN AWARD 2020 (KIVI)

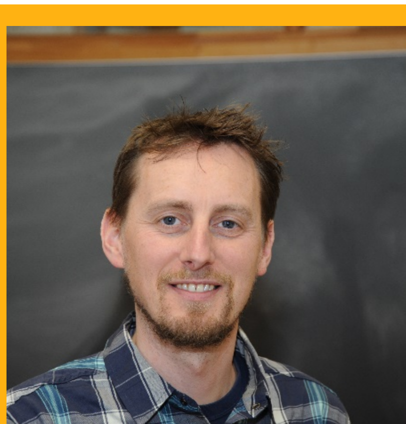
Dr.ir. Anouk Bomers (former PhD student at Twente University)

The recipient of the KIVI Hoogendoorn Fluid Mechanics Award for the best PhD thesis defended in the academic year 2019-2020 is dr.ir. Anouk Bomers, who defended her PhD thesis on 17 January 2020 at Twente University (supervisors Prof. Suzanne Hulscher (UT) and Dr Ralph Schielen (UT & Rijkswaterstaat)). The title of her PhD thesis is: “Hydraulic modelling approaches to decrease uncertainty in flood frequency relations”.

15.50-16.20

LEEN VAN WIJNGAARDEN PRIZE 2019

Dr.ir. Florian Muijres (WUR)



The Leen van Wijngaarden Prize 2019 has been awarded to Dr Florian Muijres (WUR) for his excellent work on the study of biomechanics and aerodynamics of animal flight, in which he integrates biology and physics in a very elegant way. For his research on insect flight, he focusses on insects with societal relevance such as malaria mosquitoes and pollinating bees. Florian’s bird flight research primarily focusses on the link between the biomechanics of animal flight and movement ecology. The research of Florian Muijres is positioned at the interface between biology, physics and ecology, which requires a highly interdisciplinary lab housing specialists in aerospace engineering, control theory, biology and ecology.