1ST SPANISH FLUID MECHANICS CONFERENCE

Cádiz, June 19-22, 2022

Instituto de Modelización y Simulación Numérica en Fluidodinámica, Nanociencia y Matemática Industrial "Gregorio Millán Barbany"

BStec

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Welcome to Cádiz!

Dear colleague,

It is our great pleasure to welcome you to the first edition of the Spanish Fluid Mechanics Conference. We hope that this conference will be the first in a series of biannual conferences aimed at bringing together the Spanish Fluid Mechanics community, along with their international collaborators. The conference series is inspired by similar ones in other countries; we hope that the conferences will foster scientific exchanges and collaborations among members of the Spanish and international Fluid Mechanics communities.

The strong support that this first edition has received from the community is really encouraging and foretells a bright future for the project. Indeed, this first conference will have nearly 200 participants from very different fields of Fluid Mechanics, such as turbulence, reactive flows, aerodynamics, biomedical flows, and multiphase flows. In total, the conference will feature around 150 talks, 40 posters and 4 invited talks. We are very grateful to the conference participants and to the invited speakers Antonio Crespo, César Dopazo, Javier Jiménez and Amable Liñán for their participation and support.

This conference would not have been possible without the generous financial support from our sponsors: Consejo Social de la Universidad de Cádiz, Instituto de Investigación "Gregorio Millán Barbany" (from Universidad Carlos III de Madrid), Micro Electrochemical Technologies, S.L. (B5tec), Repsol Technology Lab and the Universities of Cádiz and Carlos III de Madrid; these two universities have effected their support through their respective Plan Propio de Investigación.

We hope you have a productive conference and a wonderful time in Cádiz!

The Organizing Committee

Óscar Flores (UC3M)	Miguel Fosas de Pando (UCA)
Norberto Fueyo (UNIZAR)	Antonio J. Gámez (UCA)
J. Hermenegildo García-Ortiz (UCA)	Manuel García-Villalba (UC3M)
José Manuel Gordillo (US)	Francisco Huera-Huarte (URV)
Soledad Le Clainche (UPM)	Ignacio G. Loscertales (UMA)
Álvaro Marín (UTwente)	Elena Martín (UVigo)
Carlos Martínez-Bazán (UGR)	Javier Rodríguez (UC3M)
Joan Rosell-Llompart (URV)	Antonio Sánchez (UCSD)

Practical information

1st Spanish Fluid Mechanics Conference,
Universidad de Cádiz, June 19-22, 2022.

Contact details

🔗 https://sfmc22.uca.es   ✉ sfmc22@uca.es   🐦 @spanish_fmc

City center map

📍 **Conference venue** Edificio Constitución 1812, Paseo Carlos III, 3, 11003 Cádiz.

🍸 **Welcome cocktail** Parador de Cádiz, Av. Duque de Nájera, 9, 11002 Cádiz.

🍴 **Gala dinner** Baluarte de los Mártires. Av. Campo del Sur, s/n, 11002 Cádiz.

📶 **ucaAirPublica**, password `caminantenohaycamino`.
Log-in credentials: username `uCEC1812`, password `c937585`.

📇 Please bring your conference badge to the Welcome cocktail & Gala dinner.

Program Overview

The conference program consists of an opening session on Sunday, 12 parallel sessions of oral presentations and 3 invited lectures from Monday to Wednesday, a poster exhibit and poster awards. The winners of the poster awards will be announced during the Closing remarks on Wednesday at 14:45.

Coffee and lunch breaks will be served at the hall of the conference venue, a Welcome cocktail will be offered at Parador de Cádiz and the Gala dinner will take place at Baluarte de los Mártires.
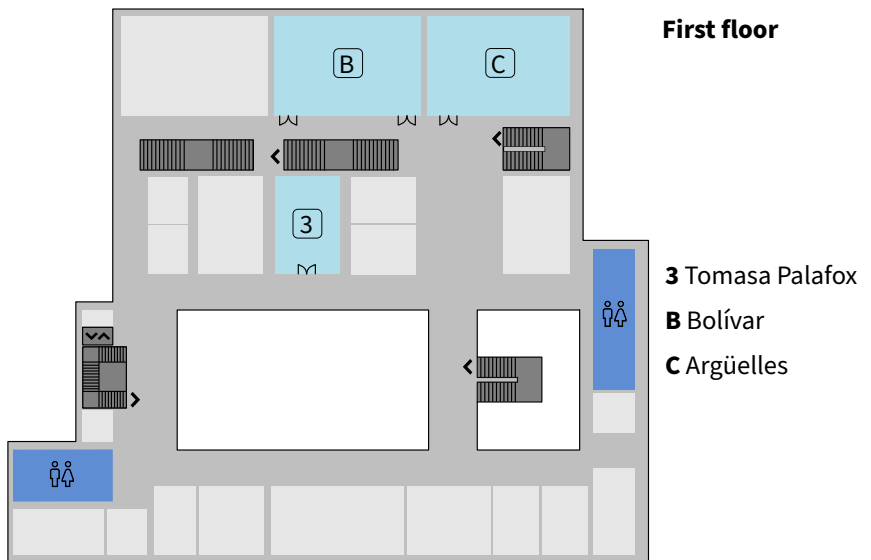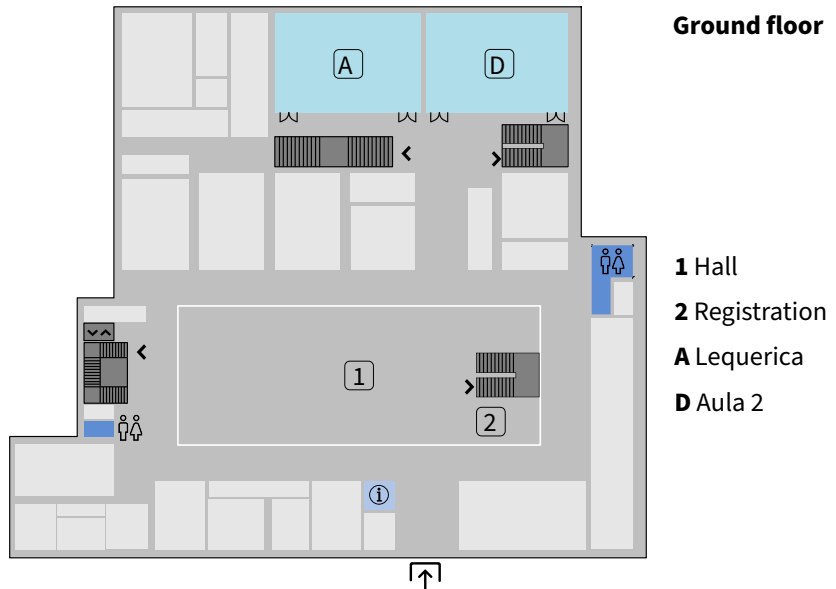
Time slot	Sunday	Monday	Tuesday	Wednesday
08:45–09:30			Registration	
09:30–10:30			Invited lectures	
		A. Crespo	J. Jiménez	C. Dopazo
10:30–11:15			Coffee break*	
11:15–12:15		1st session	6th session	11th session
12:15–13:15		2nd session	7th session	12th session
13:15–14:45			Lunch break	
14:45–15:45		3rd session	8th session	Closing remarks
15:45–16:45		4th session	9th session	
16:45–17:15			Coffee break*	
17:15–18:15		5th session	10th session	
18:15–19:00	Registration			
19:00–20:30	Opening session			
20:30–21:00				
21:00–	Welcome cocktail	Gala dinner		

* Poster contributors are requested to stand by their posters during the coffee breaks on Monday and Tuesday as indicated in the poster sessions schedule.

⚲ **Remember to vote** for your favourite poster by attaching the sticker provided at the registration to the poster of your choice **by Wednesday at 13:15**.

◖ The Spanish Section of The Combustion Institute will meet on Monday at 17:00 (Tomasa Palafox Room; see conference venue map on the next page).

Conference venue map

Ground floor

A	D

1 Hall

2 Registration

A Lequerica

D Aula 2

1

2

ℹ

First floor

B	C

3

3 Tomasa Palafox

B Bolívar

C Argüelles
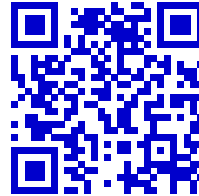
Scientific program

Program and Book of Abstracts

The latest versions of the program and the book of abstracts are available at the conference website and can be accessed by scanning the following QR codes:

Program

Book of abstracts

The digital copies feature hyperlinks that will help you navigate through the scientific program and read the abstracts of oral presentations and posters.

These documents will be archived at `https://rodin.uca.es`.

Sunday 19:00–20:30 Opening session

19:00–19:30 Welcome

19:30–20:30 Opening speech by Amable Liñán (UPM)

Amable Liñán (Noceda de Cabrera, León, Spain, 1934) is considered a world authority in the field of reactive flows. Doctor in Aeronautical Engineering, he has developed his career as a professor of Fluid Mechanics at the School of Aeronautical Engineering at the Polytechnic University of Madrid. His work has been essential in establishing a Spanish school of basic research in Fluid Mechanics with wide international projection. His scientific contributions establish a bridge between basic research and technological applications that constitutes a model to follow.

A Welcome cocktail will be served at Parador de Cádiz after the opening session. Please remember to bring your conference badge.

Monday 09:30–10:30 Invited lecture

Some fluid mechanics problems of interest to model wakes and wind farms

Invited speaker Antonio Crespo (UPM)   **Room** Lequerica (A) & Aula 2 (D)

Chair Antonio L. Sánchez (UCSD)

Wind generated energy is increasing spectacularly during the last years, and is mainly obtained from wind farms with many large wind turbines. These turbines generate wakes where there is a momentum deficit and an increased level of turbulence, that may cause a reduction in power output and unsteady fatigue loads on other machines located downstream. It is then necessary to place the turbines adequately within a defined location to minimize these interference effects. To model the wake properly it is in general required to solve the fluid mechanic equations, including an appropriate turbulence closure. This will not in general be feasible at a reasonable numerical cost because of the great number of turbines and possible arrangements. We will examine here some alternatives.

Kinematic or Analytical models. These models in general utilize the flow equations in integral from, making different assumptions about the cross flow velocity profile (gaussian, top hat, etc.) and on the downstream evolution of the wake. Important issues are also how their effects are superimposed and how to include information about turbulence characteristics. Some of these models are combined with genetic algorithms to optimize the layout of wind farms.

Reduced order models. They are associated to coherent Turbulent Flow Structures that are extracted form data obtained either numerically or experimentally. We will examine those based on POD (proper orthogonal decomposition) or DMD (Dynamic mode decomposition) modes. They can reconstruct the turbulent flow field in a more simplified way and extend the results to other scenarios. They are of interest to study dynamic flow characteristics like wake meandering, fatigue and transient loads, entrainment of large atmospheric energetic structures, turbine control methods, etc. Although not directly related to energy production, they may provide additional information of interest for wind farm optimization.

Adjoint method to optimize wind turbine lay out in a wind farm. A continuous formulation of the method, based on a RANS closure, will be briefly presented. Besides the flow equations, a system of adjoint equations has to be solved. The method gives the gradient of the energy production of the whole wind farm for small displacements of each wind turbine. The merits of the method and alternative applications will be commented.

Monday 11:15–18:15 Parallel sessions overview

Time slot	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
11:15–12:15	Turbulence I	Engineering Flows I	Biological Flows I	–
12:15–13:15	Turbulence II	Engineering Flows II	Biological Flows II	–
14:45–15:45	Turbulence III	Engineering Flows III	Self-propelled matter and collective behaviour	–
15:45–16:45	General Fluid Mechanics	Suspensions	Batteries and Fuel cells	Aeroacoustics
17:15–18:15	Machine Learning	Drops and Bubbles I	Numerical methods	Aerosols

🌢 The Spanish Section of The Combustion Institute will meet at 17:00 (Tomasa Palafox Room).

Monday 10:30–11:30 and 16:45–17:45 Poster presentations

⚥ Design of PDMS microparticles to mimic RBCs *Alejandro Rubio González (UEx)*	⚥ CFD and experimental studies of a commercial centrifugal pump *Alexia Torres (UPNA)*
⚥ CFD modelling of an unidirectional impulse turbine for a twin OWC *Bruno Pereiras García (UniOvi)*	⚥ Industrial wiping systems: Assessment of shear stress caused by wall jets *Bruno Pereiras García (UniOvi)*
Development of a blood particulate analogue fluid with the human haematocrit *Emilio José Vega Rodríguez (UEx)*	⚥ Data-driven tools to solve industrial problems *Eneko Lazpita Suinaga (UPM)*
⚥ Clustering methods modal decomposition and flow instabilities in synthetic jets *Eva Muñoz Salamanca (UPM)*	Pinning-depinning mechanism of the contact line of a liquid-air front on a patterned microchannel *Pamela Vázquez Vergara (UB)*
⚥ On the fastest and thinnest self-similar jets produced by the implosion of cavities *Francisco José Blanco-Rodríguez (US)*	The initial impact of drops cushioned by an air or vapor layer: the dynamic Leidenfrost temperature *José Manuel Gordillo Arias de Saavedra (US)*
Tip streaming of a surfactant-loaded drop in an extensional flow *José María Montanero (UEx)*	Experimental and rheological study of compressibility in flour and sugar with two different powder rheometers *Juan Ignacio Córcoles Tendero (UCLM)*
⚥ The Fluid Mechanics of splat painting *Diego Ávila García (UC3M)*	Stability of confined selective withdrawal for producing microemulsions via tip streaming *M. Guadalupe Cabezas (UEx)*
Similarity on the hydrokinetic propeller turbines: from wind tunnel experiments to the prototype scale *Marianela Machuca Macías (UCA)*	⚥ Machine learning to reconstruct data bases in fluids dynamics *Paula Díaz Morales (UPM)*
⚥ UAMMD: Complex fluids in the GPU era *Raúl Perez Pelaez (UAM)*	The effect of the angle of the incoming flow in the tandem buildings system *Renata Gnatowska (Częstochowa Univ. Technol.)*
⚥ Reduced order models in complex flows *Adrián Corrochano Calcerrada (UPM)*	⚥ **Participants in the Poster Awards.**

Monday 11:15–18:15 Parallel sessions schedule

Monday	Lequerica (A)	Bolívar (B)	Argüelles (C)
11:15–12:15	**Turbulence I** Walls, boundary layers	**Engineering Flows I** Turbines, Pumps and Valves	**Biological Flows I** Oscillatory Flows
Chair	*Javier Jiménez (UPM)*	*Antonio Viedma Robles (UPCT)*	*Antonio L. Sánchez (UCSD)*
11:15–11:30	On the influence of spanwise spectral scales in the Reynolds stress statistics in adverse-pressure gradient turbulent boundary layers. *Ramón Pozuelo Ruiz (KTH)*	A novel design method for pico-hydraulic axial turbine using dimensionless design charts *Abraham Vivas Borda (UPCT)*	Floquet stability analysis of a two-layer oscillatory flow near a flexible wall *Antonio José Bárcenas Luque (UJA)*
11:30–11:45	From wall measurements to three-dimensional turbulent-flow fields via GANs *Antonio Cuéllar Martín (UC3M)*	Centrifugal pump design guidelines using determinist flow analysis *José González Pérez (UniOvi)*	In-vitro experimental characterization of the flow of the cerebrospinal fluid in the spinal subarachnoid space *Francisco Moral-Pulido (UJA)*
11:45–12:00	Synchronized measurements of wall and flow fields in a turbulent boundary layer *Firoozeh Foroozan (UC3M)*	3D flow compensation for a 2D CFD numerical model of a VAWT in confined environments with high blockage *José González Pérez (UniOvi)*	The description of buoyancy effects on the dispersion of drugs released intrathecally in the spinal canal *Javier Alaminos-Quesada (UCSD)*
12:00–12:15		Analysis and design of micro-diode valves using topology optimization *Jorge Hervás Ortega (B5tec)*	An asymmetric pump for assisting failing Fontan circulation *Manuel García Díaz (UVa)*

Monday	Lequerica (A)	Bolívar (B)	Argüelles (C)
12:15–13:15	**Turbulence II**	**Engineering Flows II**	**Biological Flows II**
	Convection	Environmental Flows	Simulation and data analysis
Chair	*Jezabel Curbelo (UPC)*	*Sergio Chiva Vicent (UJI)*	*Manuel García-Villalba (UC3M)*
12:15–12:30	Transport properties in experimental convective flows *Jesús Ó. Rodríguez-García (Reykjavik Univ.)*	Electricity from ocean waves under climate oscillations: Mutriku 1979-2019 *Gabriel Ibarra Berastegui (UPV/EHU)*	Influence of the location point for the Fractional Flow Reserve measurement. A computational study *Daniel Fernández Martínez (UEx)*
12:30–12:45	Logarithmic behaviour of convection velocity profile in adverse pressure gradient flows *Artur Dróżdź (Częstochowa Univ. Technol.)*	CFD microscale simulation of wind flow on vicinity of a waste water treatment plant *Aina Macías Martínez (UJI)*	Effect of pulmonary vein flow split in patient-specific CFD simulations of left atrial appendage blood stasis *Eduardo Durán (UC3M)*
12:45–13:00	DNS of turbulent flow with uniform heat flux in a pipe *Luis Parras Anguita (UMA)*	Design and implementation of a passive agitator to increase UV dose in WWTPs disinfection channels *Delia Trifi Rufino (UJI)*	A new methodology for reducing the computational burden of coagulation models in biomedical flows *Manuel Guerrero Hurtado (UC3M)*
13:00–13:15	Pulsatile pipe flow in the transitional regime *Daniel Morón Montesdeoca (Univ. Bremen)*	CFD Simulations of Biomass Dust Explosions: Comparing 20-L and 1-m3 Vessels. *Alain Islas Montero (UniOvi)*	All-in-one, physics-informed denoising, dealiasing, and regularization method to exploit 4D-flow cardiac MR data *Christian Chazo Paz (H.G.U. Gregorio Marañón)*

Monday	Lequerica (A)	Bolívar (B)	Argüelles (C)
14:45–15:45	**Turbulence III**	**Engineering Flows III**	**Self-propelled matter and collective behavior**
	Multiphase	Heat Exchange	
Chair	*Isabel Mercader Calvo (UPC)*	*Miguel Hermanns (UPM)*	*Alvaro Marin (UTwente)*
14:45–15:00	Transport and deposition of fine particles in turbulent channel flow *Pedro L. García-Ybarra (UNED)*	Experimental flow pattern and friction factor of oscillatory flows in a baffled tube *José Muñoz Cámara (UPCT)*	Experimental fish swimming investigation over Astyanax species *Marianela Machuca Macías (UCA)*
15:00–15:15	Memoryless drop breakup in turbulence *Alberto Vela-Martín (Univ. Bremen)*	Entropy generation in Thermal Energy Storage water tanks *Juan Francisco Belmonte Toledo (UCLM)*	The fluid mechanics of light management in microalgae: metabolism, motility and communication *Idan Tuval (IMEDEA)*
15:15–15:30	Novel localized states in binary fluid convection in slightly inclined rectangular cells *Isabel Mercader Calvo (UPC)*	On the interaction between geothermal boreholes and groundwater flows *Javier Rico Cabrera (UPM)*	From microscopics to macroscopic hydrodynamics of collective cell motion: Active Vertex Model and Coarse-Graining of a two-dimensional cell monolayer *Gloria Irene Triguero Platero (Heidelberg Univ.)*
15:30–15:45	Thermal binary mixture convection in inclined cylindrical containers *Arantxa Alonso Maleta (UPC)*		Scale free chaos in insect swarms *Rafael González Albaladejo (UCM)*

Monday	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
15:45–16:45	**General Fluid Mechanics**	**Suspensions**	**Batteries and Fuel Cells**	**Aeroacoustics**
Chair	*Ana Carpio (UCM)*	*Idan Tuval (IMEDEA)*	*Pablo Ángel García-Salaberri (UC3M)*	*Soledad Le Clainche (UPM)*
15:45–16:00	Inviscid linear and nonlinear dynamics of viscosity stratified shear layers of one fluid surrounded by another fluid *Juan Ángel Tendero Ventanas (UCA)*	The intermittent nature of constricted concentrated suspension flows *Alvaro Marin (UTwente)*	Study of fluid-dynamic problems related with Membrane-Free Redox Flow Batteries *Santiago E. Ibáñez (IMDEA)*	New approaches to direct and adjoint sensitivity calculations for the analysis and optimisation of turbomachinery aeroacoustics *Anton Glazkov (KAUST)*
16:00–16:15	A double numerical perspective of the viscous Rayleigh-Taylor instability in a horizontally confined flow *Leo Miguel González Gutiérrez (UPM)*	Influence of non-magnetic particles in the magnetic particle deposition in microchannels *Antonio José Rivas Chacón (URV)*	Multiphase Transport Through the Membrane Electrode Assembly of Proton Exchange Fuel Cells *Pablo Ángel García-Salaberri (UC3M)*	Influence of the shape of a short circular hole with bias flow on its acoustic response *Juan Guzmán Íñigo (Imperial College London)*
16:15–16:30	Analytic Solutions and Singularities for the 2D Incompressible Adjoint Euler Equations *Carlos Lozano Rodríguez (INTA)*	Oblate spheroids settling under gravity: interactions between two particles with implications for the many-particle case. *Manuel Moriche Guerrero (KIT)*	Developments in Microfluidic Membraneless Redox Flow Batteries *Miguel de las Heras (B5tec)*	Square cylinder downstream of two different-velocity streams *Reda Mohamed Yousif Abdallah Elmansy (UPC)*
16:30–16:45	Flow dynamics between two concentric counter-rotating porous cylinders with radial through-flow *Sebastian Altmeyer (UPC)*	Dynamics of a train of solid particles moving in a channel parallel to a deformable liquid-liquid interface *Mario Sánchez Sanz (UC3M)*	Integrated Porous Electrode Optimization for Microfluidic Redox Flow Batteries *Óscar Crespo Toca (B5tec)*	Effect of broadband acoustic excitation on the separated boundary layer *Vasyl Sokolenko (Częstochowa Univ. Technol.)*

Monday	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
17:15–18:15	**Machine Learning**	**Drops and Bubbles I** Bubbles	**Numerical methods**	**Aerosols**
Chair	*Francisco Marques Truyol (UPC)*	*Rocío Bolaños (UJA)*	*Anne Gosset (UdC)*	*Antonio J. Hijano Reyes (UMA)*
17:15–17:30	On the use of Machine Learning for the estimation of the momentum source components of propellers *Jaume Luis Gómez (UJI)*	On the jetting direction during the collapse of a bubble in contact with a wall *Daniel Fuster (Sorbonne)*	Comparison of Lattice Boltzmann collision models for scale resolving simulations *Jorge Ponsin Roca (INTA)*	Structure of deposits formed by aerosol particles collected on attracting or slightly repelling surfaces *José L. Castillo (UNED)*
17:30–17:45	Sub-grid modelling for Large Eddy Simulation using Artificial Neural Networks *Salvador Navarro-Martínez (Imperial College London)*	Experimental and numerical study of a bubble rising close to a vertical surface *Cecilia Estepa-Cantero (UGR)*	A conservative Cartesian cut cell method and its application to the incompressible Navier-Stokes equations *Alejandro Quirós Rodríguez (Sorbonne)*	Predicting aerosol capture characteristics of fibrous filters, including fiber dispersity and aerosol 'morphologies' with interception diameter larger than mobility diameter *Manuel Arias-Zugasti (UNED)*
17:45–18:00	Leveraging data-driven real-time CFD simulation in reactors *Paloma Barreda Juan (UJI)*	Coalescence frequency of unequal sized bubbles in confined inertial swarms *Javier Ruiz-Rus (UJA)*	Quantum computing CFD simulations: myth and reality *Giulio Malinverno (FIMAC S.p.A.)*	Airborne disease transmission and Fluid Dynamics: Direct Numerical Simulations of a violent expiratory event and the dispersion of the resulting droplet cloud *Alexandre Fabregat Tomas (URV)*
18:00–18:15			State-of-the-art SPH solver DualSPHysics: from fluid dynamics to multiphysics problems *Moncho Gómez Gesteira (UVigo)*	

Tuesday 09:30–10:30 Invited lecture

On chickens, eggs and turbulence

Invited speaker Javier Jiménez (UPM)   **Room** Lequerica (A) & Aula 2 (D)

Chair Manuel García-Villalba (UC3M)

The question of why things happen has traditionally attracted philosophers, who tend to centre on 'fundamental' problems such as the reason why us, or anything, are here. It remains largely unsettled. The 'simpler' question of how things happen has mostly been the business of engineers and scientists, and it is probable that the main reason why philosophical causality remains unsolved is that philosophers do not know how their 'fundamental' systems work. However, understanding causality would be useful to all of us, because it would allow problems to be generalised and thus suggest new courses of action. The more restricted world of fluid dynamics has the opposite problem: we know how things happen (they follow the Navier-Stokes equations), but, even if we are numerically or experimentally able to solve the equations, the solutions are so complicated that it is difficult to decide why individual events take place. Why did a severe tornado happen over Cádiz (in the XVII century)? Was anybody responsible? Could something have been done about it? We will examine how the intuitive idea of causality, developed for systems that are only partially understood, such as chickens and eggs, can be extended to deterministic dynamical systems and to turbulent fluid flow, whose evolution we think we understand. We will argue that practical causality implies defining 'coherent' structures that isolate flow neighbourhoods (in some coordinate space that has to be determined), but that the two are not identical. In a sense that can be made precise, structures that are coherent are not causal, and vice-versa. We will present examples of what are we learning about two- and three-dimensional turbulent flows by applying these ideas, and discuss ways in which the field can move forward, as well as some of the difficulties that can be anticipated.

Tuesday 11:15–18:15 Parallel sessions overview

Time slot	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
11:15–12:15	Compressible Flows	Turbulence IV	Reactive Flows I	–
12:15–13:15	Engineering Flows IV	Engineering Flows V	Reactive Flows II	–
14:45–15:45	Drops and Bubbles II	Turbulence V	Reactive Flows III	–
15:45–16:45	Numerical Methods and Machine Learning	Electro- and magneto-hydrodynamics I	Reactive Flows IV	Thin Films and Coating Flows
17:15–18:15	Drops and Bubbles III	Electro- and magneto-hydrodynamics II	Engineering Flows VI	Fluid Structure Interaction I

Tuesday 10:30–11:30 and 16:45–17:45 Poster presentations

⚲ Theory of turbulence augmentation across hypersonic shock waves in air
Alberto Cuadra Lara (UC3M)

⚲ Capillary imbibition on a 3D-printed metallic rough surface with grooves
Borja Cobo López (Madrid Space)

A numerical method for articulated bodies in viscous flows
Florencio Balboa Usabiaga (BCAM)

⚲ From microscopics to macroscopic hydrodynamics of collective cell motion: Active Vertex Model and Coarse-Graining of a two-dimensional cell monolayer
Gloria Irene Triguero Platero (Uni Heidelberg)

On the motion of a liquid-metal drop inside a capillary tube
Javier Otero Martínez (UC3M)

⚲ Effect of large streamwise gradients on laminar-turbulent transition - A new numerical approach -
Juan Alberto Franco (DLR)

Dynamics of a train of solid particles moving in a channel parallel to a deformable liquid-liquid interface
Mario Sánchez Sanz (UC3M)

Hydrodynamics of quartz crystal microbalance experiments using discrete molecules
Rafael Delgado Buscalioni (UAM)

Embedding of PID controllers into CFD simulations of lifting surfaces
Sócrates Fernández

⚲ CFD Simulations of Biomass Dust Explosions: Comparing 20-L and 1-m3 Vessels.
Alain Islas Montero (UniOvi)

Lattice-Boltzmann modeling of lifted hydrogen jet flames: a new model for hazardous ignition prediction
Alejandro Millán Merino (Aix Marseille Univ.)

⚲ Synchronized measurements of wall and flow fields in a turbulent boundary layer
Firoozeh Foroozan (UC3M)

⚲ Quantum computing CFD simulations: myth and reality
Giulio Malinverno (FIMAC S.p.A.)

The fluid mechanics of light management in microalgae: metabolism motility and communication
Idan Tuval (IMEDEA)

Modal stability analysis of a hypersonic flow over a compression ramp
José Miguel Pérez (UPM)

⚲ Pinching of a leaky-dielectric liquid filament subjected to an axial electric field
Manuel Ángel Rubio Chaves (UEx)

Multiphase Transport Through the Membrane Electrode Assembly of Proton Exchange Fuel Cells
Pablo Ángel García-Salaberri (UC3M)

⚲ A two-phase mixing layer between parallel gas and liquid streams: Flow structures analysis and deep learning
Santos Rodrigo Abadía Heredia (UPM)

⚲ Effect of broadband acoustic excitation on the separated boundary layer
Vasyl Sokolenko (Częstochowa Univ. Technol.)

⚲ **Participants in the Poster Awards.**

Tuesday 11:15–18:15 Parallel sessions schedule

Tuesday	Lequerica (A)	Bolívar (B)	Argüelles (C)
11:15–12:15	**Compressible Flows**	**Turbulence IV** Jet Flows	**Reactive Flows I** Transport and Chemistry
Chair	*César Huete (UC3M)*	*Luis Parras Anguita (UMA)*	*Daniel Mira (BSC)*
11:15–11:30	Theory of turbulence augmentation across hypersonic shock waves in air *Alberto Cuadra Lara (UC3M)*	Analysis of Linear Dynamics of High-Speed Jet Flows Using a Dual-PIV – Dynamic Mode Decomposition Approach *Vishal Chaugule (Monash Univ.)*	Application of an efficient and accurate multicomponent transport approximation *Bertrand Naud (CIEMAT)*
11:30–11:45	On the stability of steady shock waves *César Huete (UC3M)*	Flow-field estimation of jet flow from point sensors *Eduardo Gil (UC3M)*	Convergence rate and dependence on polyatomic effects of recent accurate and efficient multicomponent transport iterative algorithm *Manuel Arias-Zugasti (UNED)*
11:45–12:00	Modal stability analysis of a hypersonic flow over a compression ramp *José Miguel Pérez (UPM)*	Extracting advecting flow structures through Hilbert Proper Orthogonal Decomposition *Marco Raiola (UC3M)*	Dynamic adaptive chemistry methods applied to an unsteady multi-regime combustion problem *Anurag Surapaneni (BSC)*
12:00–12:15	Aerodynamic Study of the NASA's X-43A Hypersonic Aircraft *Josep Maria Bergadà Granyó (UPC)*		Reduced order models in complex flows *Adrián Corrochano Calcerrada (UPM)*

Tuesday	Lequerica (A)	Bolívar (B)	Argüelles (C)
12:15–13:15	**Engineering Flows IV** Multiphase and open flows	**Engineering Flows V** Wiping, coating	**Reactive Flows II**
Chair	Pedro L. García-Ybarra (UNED)	Javier Rodríguez-Rodríguez (UC3M)	Bertrand Naud (CIEMAT)
12:15–12:30	Characterization of an industrial air-water diffuser flow by conductivity probe *Óscar Prades Mateu (UJI)*	High and low fidelity models to investigate the instabilities in jet wiping *David Barreiro Villaverde (UdC)*	Application of the discrete-sectional method for the study of soot formation in an aeroengine model combustor using large-eddy simulations *Daniel Mira (BSC)*
12:30–12:45	Hydrodynamic analysis of a bubbling fluidized bed with an immersed tube bundle based on CPFD numerical simulations *Juan Ignacio Córcoles Tendero (UCLM)*	CFD-VOF Analysis of an Air-knife for Wiping Thin Water Layers *Bruno Pereiras García (UniOvi)*	Numerical analysis of symmetric to non-symmetric flamefront transition in slender microchannels *David Rodríguez Gutiérrez (INTA)*
12:45–13:00	CFD simulation of fishing nets with simplified knots *Sergio Roget Mourelle (UdC)*	Impingement pressure for experimental wiping systems characterization *Bruno Pereiras García (UniOvi)*	Thermoacoustic modes and coupling regions of premixed flames in non-adiabatic tubes *Víctor Muntean Erhan (UPM)*
13:00–13:15	High-resolution measurements and numerical modelling of resonant standing waves in a channel lateral cavity *Juan Mairal Ascaso (Unizar)*	Coating Flow on a Rotating Cylinder Subject to an Airflow *Andrew Mitchell (Univ. Strathclyde)*	Asymptotic analysis of superadiabatic combustors with a two-step chain-branching chemistry model *Francisco Javier Bosch Calvo (CIEMAT)*

Tuesday	Lequerica (A)	Bolívar (B)	Argüelles (C)
14:45–15:45	**Drops and Bubbles II**	**Turbulence V**	**Reactive Flows III**
		Fluctuations, structure	
Chair	*Lorène Champougny (UC3M)*	*Rodolfo Ostilla-Mónico (UCA)*	*César Dopazo (Unizar)*
14:45–15:00	Thermal antibubbles: when thermalization of encapsulated Leidenfrost drops matters *Benoit Scheid (ULB)*	Underlying exact coherent structures within spiral turbulence *Alvaro Meseguer (UPC)*	Lattice-Boltzmann modeling of lifted hydrogen jet flames: a new model for hazardous ignition prediction *Alejandro Millán Merino (Aix Marseille Univ.)*
15:00–15:15	Hydrodynamic Spin Lattices *Pedro J. Sáenz (UNC-Chapel Hill)*	Discovery of significant regions in isotropic turbulence by massive machine manipulation *Miguel P. Encinar (UPM)*	Structure and propagation characteristics of premixed ammonia flames under different turbulent conditions *Hong G. Im (KAUST)*
15:15–15:30	The role of friction on the splashing of drops impacting over superhydrophobic substrates *Guillaume Riboux (US)*	Exploring Fluctuation-Induced Forces in Homogeneous Isotropic Turbulence *Rodolfo Ostilla-Mónico (UCA)*	Numerical study on the effect of hydrogen enrichment of a lean natural gas technically premixed flame *Leonardo Pachano (BSC)*
15:30–15:45		Vortex merging and splitting: a mechanism for transition to elasto-inertial turbulence in viscoelastic Taylor–Couette flows *José Manuel López Alonso (UPC)*	Minimum Ignition Energy of Hydrogen-Ammonia mixtures in air *Eduardo Fernández-Tarrazo (UC3M)*

Tuesday	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
15:45–16:45	**Numerical Methods and Machine Learning**	**Electro- and magneto-hydrodynamics I** Electrified Menisci	**Reactive Flows IV** Instabilities	**Thin Film and Coating Flows**
Chair	*Miguel Ángel Herrada (US)*	*Ignacio G. Loscertales (UMA)*	*Carlos Martínez Bazán (UGR)*	*Benoit Scheid (ULB)*
15:45–16:00	A numerical method for articulated bodies in viscous flows *Florencio Balboa Usabiaga (BCAM)*	Resonance of electrified and non electrified pinned droplets *Antonio J. Hijano Reyes (UMA)*	Suppression of thermoacoustic instabilities by flame-structure interaction *Mariano Rubio-Rubio (UC3M)*	On the dewetting of ultra-thin spherical coatings *Daniel Moreno Boza (UC3M)*
16:00–16:15	A two-phase mixing layer between parallel gas and liquid streams: Flow structures analysis and deep learning *Santos Rodrigo Abadía Heredia (UPM)*	Modal analysis of pure conductor electrified menisci *Javier Rivero-Rodríguez (UMA)*	A pseudo-active approach for the control of combustion instabilities *Javier Ballester (Unizar)*	The non-axisymmetric coating of a vertical fibre by a thick film of fluid *James Daniel Reilly (Univ. Strathclyde)*
16:15–16:30	Physics informed learning of constitutive equations for multiscale simulation of dilute polymeric solutions *David Nieto Simavilla (BCAM)*	Liquid Metal Electro-dripping *Jorge Aranda López (UMA)*	Influence of momentum loss on hydrodynamically unstable premixed flames *Daniel Fernández-Galisteo (CIEMAT)*	Dip-coating flow in the presence of two immiscible liquids *Lorène Champougny (UC3M)*
16:30–16:45	A porous medium approach to assess the aerodynamics of a drying kiln with CFD *Anne Gosset (UdC)*		Modelling and simulation of the electrolyte flow in the tanks of vanadium redox flow batteries *Pablo Ángel Prieto Díaz (UC3M)*	Dynamics of hole growth in a surfactant-coated thin film *Marco De Corato (Unizar)*

Tuesday	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
17:15–18:15	**Drops and Bubbles III** Capillary effects and mass transfer	**Electro- and magneto-hydrodynamics II**	**Engineering Flows VI** Aeronautical applications	**Fluid Structure Interaction I**
Chair	*Daniel Fuster (Sorbonne)*	*Jose María Montanero (UEx)*	*J. Ignacio Jiménez González (UJA)*	*Elena B. Martín (UVigo)*
17:15–17:30	The growth of hydrogen bubbles in water electrolysis in an acidic medium *Francisco Higuera (UC3M)*	On the motion of a liquid-metal drop inside a capillary tube *Javier Otero Martínez (UC3M)*	Nonlinear interpolation of steady transonic flows via manifold learning and neural networks *Jaime Bowen Varela (INTA)*	Numerical validation of simple non-stationary models for self-propelled pitching foils *Pablo Esteban López-Tello (UMA)*
17:30–17:45	Impact of gas-phase pyrolysis on the vaporization of alkane droplets at high temperature *Álvaro Muelas (Unizar)*	Pinching of a leaky-dielectric liquid filament subjected to an axial electric field *Manuel Ángel Rubio Chaves (UEx)*	Effect of disc inclination on drag *Sukruth Satheesh (Univ. Poitiers)*	Higher Order Dynamic Mode Decomposition to identify decay in trailing vortices *Carlos del Pino (UMA)*
17:45–18:00	Capillary imbibition on a 3D-printed metallic rough surface with grooves *Borja Cobo López (Madrid Space)*	Magnetic UAMMD: Magnetic colloids immersed in a fluid *Pablo Palacios Alonso (IMDEA)*	Embedding of PID controllers into CFD simulations of lifting surfaces *Sócrates Fernández*	Histeretical behaviour of two-dimensional vortex shedding past the NACA0012 airfoil at ultra-low Reynolds number *Fernando Mellibovsky (UPC)*
18:00–18:15	Evaporation dynamics of respiratory-like droplets and their implications in virus infectability *Javier Rodríguez-Rodríguez (UC3M)*	Hydrodynamics of quartz crystal microbalance experiments using discrete molecules *Rafael Delgado Buscalioni (UAM)*	Optimization of synthetic jet actuation on a SD7003 airfoil in stall conditions *Josep Maria Bergadà Granyó (UPC)*	Aerodynamic characterization of a deformed wing model *Paloma Gutierrez-Castillo (UMA)*

Wednesday 09:30–10:30 Invited lecture

Modelling micro-mixing: A child's guide to turbulent reacting flows

Invited speaker César Dopazo (UNIZAR) **Room** Lequerica (A) & Aula 2 (D)

Chair Carlos Martínez Bazán (UGR)

The mixing of inert and reactive scalars with constant molecular diffusivities, convected by a statistically homogeneous turbulent flow of a constant density fluid, is described. The scalar evolution from large structures to fine-scales in turbulent shear flows is explained. The micro-mixing problem is illustrated in the context of the transported probability density function (TPDF) method.

Classical micro-mixing models for the single-point scalar PDF are presented. The Linear Mean Square Estimation (LMSE) model, proposed fifty years ago, expresses the conditional molecular diffusion as a linear function of scalar fluctuations with a slope inversely proportional to a micro-mixing time, which embodies the interplay between small-scale turbulence, molecular diffusion and reaction. The LMSE model relaxes the scalar towards its mean value, but the PDF maintains its initial shape. Moreover, the micro-mixing time is set proportional to the ratio of the turbulent kinetic energy (TKE) and the TKE dissipation rate. Additionally, differential diffusion among various species is not accounted for. A Wiener process, added to the LMSE, can relax the initial PDF to a Gaussian. The Modified Curl model and the Mapping closure address also the initial PDF modification. The Euclidean Minimum Spanning Tree (EMST) model allows mixing only between neighboring Monte Carlo particles. Current efforts in micro-mixing model development aim at distinguishing characteristic times, determined either by reaction or by turbulence.

A novel model is discussed for the joint scalar/scalar-gradient statistics. The competition among small-scale turbulence, molecular diffusion and reaction is explicitly reflected only in the scalar-gradient transport equation. The time evolution of scalar and scalar-gradient magnitude of Monte Carlo particles needs closures of the normal and tangential molecular diffusions and of the flow normal strain rate. Discretization of the diffusive terms brings into play the normal distance between two adjacent iso-scalar surfaces, which displays a time-dependent statistical distribution. The temporal evolution of the mean curvature of iso-scalar surfaces must be externally supplied. This model can be extended to turbulent shear flows of variable density fluids.

Wednesday 11:15–13:15 Parallel sessions overview

Time slot	Lequerica (A)	Bolívar (B)	Argüelles (C)	Aula 2 (D)
11:15–12:15	Fluid Structure Interaction II	Control and Drag Reduction I	–	–
12:15–13:15	Fluid Structure Interaction III	Control and Drag Reduction II	Convection and Gravity-driven Flows	–

Wednesday 14:45–15:45 Closing session

The members of the Poster Award jury will announce the winner during the closing ceremony, which will end with a brief speech from the organizing committee and invited speakers.

Wednesday 11:15–13:15 Parallel sessions schedule

Wednesday	Lequerica (A)	Bolívar (B)
11:15–12:15	Fluid Structure Interaction II	Control and Drag Reduction I
Chair	Francisco Huera-Huarte (URV)	Carlos del Pino (UMA)
11:15–11:30	Attenuation of vortex-induced vibrations of a circular cylinder with rear flexibly-hinged splitter plate. José Carlos Muñoz Hervás (UJA)	Active drag reduction in minimal flow units via deep reinforcement learning Stefano Discetti (UC3M)
11:30–11:45	Numerical study of flow around vortex generators Beatriz Méndez López (CENER)	Drag reduction of an Ahmed body through reconfiguration of rear flexibly-hinged plates José Manuel Camacho Sánchez (UJA)
11:45–12:00	Flapping near the free surface Francisco Huera-Huarte (URV)	Optimal disturbances over a streamwise grooved plate Juan Ángel Martín (UPM)
12:00–12:15	Numerical investigations of the different regimes in canopy flows Alfredo Pinelli (City, Univ. London)	Understanding trailing-vortex meandering using non-equilibrium statistical mechanics Tobias Bölle (DLR)

Wednesday	Lequerica (A)	Bolívar (B)	Argüelles (C)
12:15–13:15	**Fluid Structure Interaction III**	**Control and Drag Reduction II**	**Convection and Gravity-driven Flows**
Chair	*Alfredo Pinelli (City, Univ. London)*	*Stefano Discetti (UC3M)*	*Arantxa Alonso Maleta (UPC)*
12:15–12:30	Mixing quantification of a confined polymer flow past a cross-wise moving squared prism *Elena B. Martín (UVigo)*	Effect of large streamwise gradients on laminar-turbulent transition - A new numerical approach - *Juan Alberto Franco (DLR)*	Thermal plume dynamics in a stratified ambient *Francisco Marques Truyol (UPC)*
12:30–12:45	Forces and 3D deflection study of insect-inspired two-vein flapping wings *Carlos García Baena (UJA)*	Trading off gradient and multi-fidelity information for global optimization in numerical flow simulations *Anthony Larroque (UCA)*	Playground for compressible Rayleigh-Bénard convection with an infinite Prandtl number *Jezabel Curbelo (UPC)*
12:45–13:00	Topology controls the emergent dynamics in nonlinear flow networks: towards an excitable fluidic system *Miguel Ruiz García (UC3M)*	A new passive flow separation control method employing a two-dimensional surface corrugation *Paweł Niegodajew (Częstochowa Univ. Technol.)*	Gravity-induced regimes of a sphere settling in ambient fluid: the effect of free-stream perturbations *Juan Manuel Catalán (UC3M)*
13:00–13:15		Pulsed jets in cross-flow for convective heat transfer enhancement *Rodrigo Castellanos (UC3M)*	Experimental characterization of the fluid-body synchronization mechanisms of freely falling cylinders *Manuel Lorite-Díez (UGR)*

Social program

Sunday 21:00 Welcome cocktail
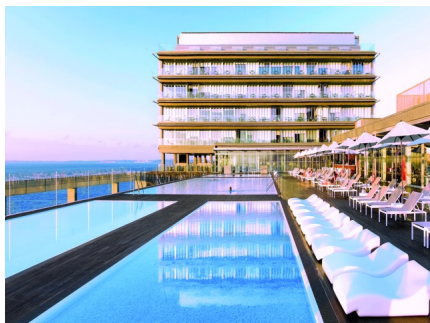
After the opening session we will enjoy a cocktail together at *Parador de Cádiz*. 🍸 Av. Duque de Nájera, 9, 11002 Cádiz. **How to get there?** 5 minute-walk from the conference venue. 🚌 2 and 7.

Monday 21:00 Gala dinner

Baluarte de los Mártires, built in 1676 and restored in 1990, makes up one of the defensive complexes of the city of Cadiz, a unique historical enclave open to the Atlantic Ocean. Flanked on one side by the *Paseo Marítimo* and on the other by *La Caleta* Beach, it stands in front of the *Castle of San Sebastián* and its lighthouse. Hope you enjoy!

🍴 Av. Campo del Sur, s/n, 11002 Cádiz **How to get there?** 15 minute-walk from the conference venue. 🚌 2 and 7.

Instructions

for Speakers

Speakers are requested to upload their presentation to the computer that is available in the assigned conference room, preferably in PDF format, well in advance. Plugging laptops to the projector system is not recommended. Speaker Ready Room - Room D (see Conference Map page) will be open in the mornings (before lunch) for those speakers who wish to try their presentation.

The duration of the talk must be 12 minutes, plus 2 minutes of questions and 1 additional minute to change to the next speaker. In each room there will be a monitor showing the talk time, with the following color code: **GREEN**, first 10 minutes of the talk, **YELLOW**, last 2 minutes of the talk, **RED**, Question & Answers time and **BLACK** will indicate the additional minute to change speaker.

for poster presenters

Posters will be displayed at the Hall during the coffee breaks and presented by their authors as indicated in the program. Poster presenting authors will find there material to post their poster on the stands. We advise the authors to do this at the beginning of the coffee break on Monday.

for the participants in the Poster Awards ♀

Participants in the Poster Awards must paste the sticker that will be provided at registration on their poster. During their assigned session, the jury will visit the poster and discuss about its content with the presenter. Their decision will be based on the scientific content (rigor, relevance, etc.), poster presentation (clarity, quality of plots and figures, design, etc.), oral presentation and discussion. The conference participants will also be able to vote for their favorite poster by pasting their sticker on the poster of their choice. The winners will be announced on Wednesday during the closing session (14.45).

for session chairs

Due to the number of participants and parallel sessions, speakers must finish their presentation and question rounds on time. The chair is in charge of indicating the speakers when to start, when to stop and when he/she can move on to the stage to connect the computer, etc. To help keep the time, every room has a monitor with a color-coded timing system (see above). If you have any question or incidence, please contact the organizing committee.