UNIVERSITAT POLITÈCNICA DE VALÈNCIA

cmt motores térmicos

International Advanced Course in Liquid Interfaces, Drops and Sprays (LIDESP V)

Valencia, Spain, 4th – 5th Sept 2017

http://www.cmt.upv.es/ILASS2017/Default.aspx

International Course Directors

A. Amirfazli, V. Bertola, M. Marengo

Host Director

R. Payri

COURSE DESCRIPTION

LIDESP is an International Advanced Course on the Interface, Drops and Liquid Sprays Physics, which is held every year in different locations around the world. The core of the lecture plan is provided by three well-known and highly recognized experts in the field: Prof. Amirfazli, York University, Toronto, Canada, Prof. Bertola, University of Liverpool, UK, Prof. Marengo, University of Brighton, UK. They not only deliver part of the instructional module, but also every year, depending on the venue, different modules of the program are taught by local experts, under the coordination of Host Directors.

The **knowledge** of the physics of liquid drops and sprays is essential for many applications, from aeronautics (icing) to oil extraction (effervescent spray, drop collisions in pipes), from electronics (spray cooling) to agriculture (pesticide distribution), from microfluidics (droplet management) to painting processes (spray coating), from biology (blood droplets, sterilization) to thermal transfer (condensation in heat exchangers), from chemistry (drying tower) to medical applications.
The course **objective** is to provide the participants with today's detailed knowledge on the physics of drops and sprays based on recent research results and the most updated methods for the prediction of dynamic outcomes, heat transfer, wettability effects, and its applications to technological and industrial areas. Specific attention will be paid to the applications in life science, such as microdroplet management. Application to chemical processes will be dealt with special care in view of the industrial interest towards this component, while the very recent application of drop management in microscale, including microstructured surfaces will be treated in detail. In terms of mathematics and physics, the course is at the level of a good Postgraduate and Ph.D. degree.
This time the course has also a special high level part about **engine sprays**.

The course is addressed to scientists, professionals, company engineers, R&D managers and graduate students in the fields of Engineering, Chemistry, Biology, Medicine, Applied and Fundamental Sciences. This course is especially of interest to those dealing with phenomena involving drops and sprays, in order to get acquainted with the traditional background and the most recent developments of this discipline.

The pre-requisites are a preparation in Mathematics and Physics equivalent to a Master Degree in Engineering. Physics or Chemistry and a good university preparation in fluid-dynamics and heat transfer.

The course is sponsored by the European Institute of Liquid Atomization and Spray Systems (ILASS EUROPE) and Universitat Politecnica de Valencia (Spain).

COURSE PROGRAM

	Mon – 4/9	Tuesday – 5/9	
	Introduction	Drop Physics Liquid Sprays	Engine sprays
08.40-09.30	Registration	A1 – AA5	
09.30-10.20	I1 – AA1	D2 – MM3	S1 – VB5
10.20-11.10	I1 – AA2	D2 – MM4	S1 – VB6
11.10-11.30	Coffee break	Coffee break	
11.30-12.20	I2 – MM1	D3 – VB2	ES1 – RP
12.20-13.10	I2 – MM2	D3 – VB3	ES1 – RP
13:10-14.00	*Lunch*	*Lunch*	
14.00-14.50	I3 – VB1	D4 – VB4	ES2 – JMG
14.50-15:40	D1 – AA3	S1 – MM5	ES2 – JMG
15.40-17.00	*Coffee break*	*Coffee break*	
17:00-17.50	D1 – AA4	S1 – MM6	ES3 – JMP
17:50-18.40	Visit CMT labs - RP	S2 – JVP	ES3 – RN
18.40-19:30	Experiments 1– RP	Experiments 2 CMT - RP	
	DINNER		

* On Tuesday September 5th each participant in the course can decide which of the two sections would like to join.

CONTENTS

I1 *Introduction and basic concepts.* Gallery of basic phenomena, micro- to macro- scale (molecular dynamics/continuum approaches), contact angle, Young equation, Laplace pressure, Free Gibbs Energy, Marangoni effects – **Amirfazli**

I2 *Introduction to fluid mechanics of liquid interfaces.* Basic equations, Navier-Stokes equations for capillary flows, liquid jet break-up – **Marengo**

I3 *Surface tension & measurement techniques.* Equilibrium and dynamic surface tension. De Nouy/Wilhelmy, sessile drop and pendant drop (ADSA), maximum bubble pressure. – **Bertola**

D1 *Dynamics of drops deposited on a surface.* Sessile drops, spreading law, apparent and real contact angles. Drop shedding, contact angle hysteresis – **Amirfazli**

D2 *Introduction to drop-wall interactions*. Drop impact on dry and wetted surfaces. Morphology. Shallow and thick layers. Splashing correlations. **Marengo**

D3 *Heat and mass transfer in drops.* Mono-component droplet heating and evaporation. Abramzon and Sirignano model. **Bertola**

D4 *Drop impact on heated surfaces.* Introduction to drop impact onto heated surfaces. Impact regime maps. Transitions. Dynamic Leidenfrost temperature. Control of secondary atomization and splashing. – **Bertola**

A1 *Superhydrophobicity.* Application of superhydrophobic surfaces. Cassie-Wenzel and competing theories. Types of SHS and manufacturing techniques. Impact on SHS surfaces. Impalement transition – **Amirfazli**

S1 *Physics of sprays and applications.* Spray formation, atomization models. Evaporation, gas entrainment, impact. – **Marengo / Bertola**

S2 *Spray characterization*. Measurement of drop size and drop flux densities. Optical techniques. Point and planar techniques. Advantages and disadvantages. – **J.V. Pastor**

ES1 – Hydraulic characterization, injection rate and spray momentum, 1D modelling of common rail injectors – **Raul Payri**.

ES2 – *Reactive dynamics of Diesel sprays*. Diesel spray evaporation, mixing and ignition. Scaling laws and 1D modelling. - **Jose M. Garcia-Oliver**

ES3 –3D CFD non reactive spray modelling: approaches and application to engine sprays - **Jose Manuel Pastor**

ES3 –3D CFD reactive spray modelling – **Ricardo Novella**

Experiments 1 – Diesel Spray measurements in a high pressure and high temperature vessel – **R. Payri**

Experiments 2 – Injection rate, spray momentum and Spray visualization for a gasoline direct injector – **R. Payri**

LECTURERS

Prof. Alidad Amirfazli

Before joining the York University as the founding Chair of the Department of Mechanical Engineering, Alidad Amirfazli held the Canada Research Chair in Surface Engineering at the University of Alberta, Canada. Amirfazli has produced exciting results in wetting behavior of surfaces, drop adhesion and shedding, understanding and application of superhydrophobic coatings. He has more than 200 scientific contributions, many in prestigious peer reviewed journals; he is the Editor for the Advances in Colloid and Interface Science. Dr. Amirfazli has been the recipient of the Martha Cook Piper Research prize, Killam Annual Professorship, and Petro-Canada Young Innovator Award. He also served in the board of Professional Engineers of Alberta, and been a consultant with various companies in USA, Europe, and Canada.

Prof. Volfango Bertola

Joined the University of Liverpool in 2011, after holding a Lectureship at the University of Edinburgh (2004-1011) and a Marie Curie Fellowship at the Ecole Normale Supérieure in Paris (2001-2004). In 2009-10 he was Visiting Professor and Lagrange Fellow at Politecnico di Torino (Italy). He has more than 100 scientific publications in the areas of soft matter, multiphase flows, and thermodynamics, including several contributions on non-Newtonian drops and on the dynamic wetting of complex fluids. He has been the recipient of a Royal Academy of Engineering Global Research Award (2009) and the UIT Young Scientist Prize (2001).

Prof. Marco Marengo

Graduated in Physics at the University of Turin cum laude and completed his Ph.D. studies at the Polytechnic of Milan, Italy, and University of Erlangen, Germany, with a thesis about "Drop Impingement on Liquid Film". He was awarded by the Deutscher Akademischer Austauschdienst (DAAD) and by the European Community TMR Program. From 2002 he is associate professor of Thermal Physics at the University of Bergamo and since 2014 he is Professor of Thermal Engineering at the University of Brighton. Since 2009 he is European Editor of the Journal "Atomization & Sprays". Visiting Professor at the University of Mons-Hainaut since 2005. He is member of the International Heat Pipe Conference board and member of the Space Environment Working Group of the UK Space Agency. He published more than 200 scientific papers, many of them in peer-reviewed journals about liquid sprays, drop impact, heat pipes, building physics. He has received more than 30 invitations for plenary lectures and seminars.

Prof. Raul Payri

Prof. Raul Payri graduated as an industrial engineer in 1995. He completed his doctoral thesis in 1999 obtaining one of the six awards of the 130 thesis defended that year. Teaching since 1998 he became Full Professor at Universitat Politecnica de Valencia in 2009.

Dr. Payri is currently the manager of the injection group formed by 20 engineers. He has worked in more than 150 research projects funded by companies such as Puegeot-Citroen, Ford, General Motors, Renault, Fiat, BMW, General Electric, Daimler, Delphi, Jaguar Land Rover, Toyota. The dissemination of results has taken place over the publication of 80 articles in scientific journals and 60 international conference papers. His h-citation index is 26 the second highest in mechanical engineering in Spain. He has supervised 7 doctoral theses and over 70 master projects. Professor Payri is acting as conference chairman for ILASS2017 that will be held in Valencia.

Prof. José V. Pastor

Graduated in Physics in 1991, completed his PhD thesis on measurement with LDV of internal aerodynamics in Diesel engines in 1996. Currently Professor at the University and leads a research division on Optical Diagnostics at CMT-Motores Térmicos, working on the development of advanced experimental techniques and models for engine combustion. He has supervised 7 PhD theses, and participated in more than 100 R&D projects with public or private funding in the automotive sector including many EC contacts since FP3, and has been the scientist in charge of CMT activities on new fuels potential as a future fuel for Internal Combustion Engine applications, such as metal nanoparticles or dual fuel strategies

Ass. Prof. Jose M. Garcia-Oliver

José M. García-Oliver received his degree in Industrial Engineering at the Universitat Politècnica de València in 1998, and later a PhD at the CMT-Motores Térmicos Institute in 2004.

His scientific and technical interests have been aimed at the combination of both experimental (optical techniques) and calculation (1D and CFD) tools to describe in detail the complex phenomena that take place within the combustion chamber of Diesel engines. As a result of such activities, he has published more than 30 indexed journal papers, he has supervised 5 PhD theses and he has participated in several public projects and private contracts with the automotive industry, in some of them acting as IP.

Additionally, he has collaborated with other research institutions within the frame of scientific visits, as well as serving as session organizer for the SAE Congress and coordinating activities within the Engine Combustion Network.

	**Ass Prof. Jose Manuel Pastor** Dr. J.M. Pastor graduated in Industrial Engineering in 1998 and achieved his PhD degree in 2003 at Universitat Politècnica de València. He is working as a Senior Researcher at Instituto CMT-Motores Térmicos since 2006. Dr. Pastor has over 10 years' experience in engine spray and combustion numerical simulations, participating in more than 50 projects with the industry and academia. The outcome of his research activity has been published in 25 journal and 20 conference papers.
	**Ass. Prof. Ricardo Novella** Dr. R. Novella graduated in Industrial Engineering in 2004 and achieved his PhD degree in 2009 at Universitat Politècnica de València, obtaining an award for its excellence. From year 2000 he is combining his teaching activities in the field of thermodynamics and thermal engines with his research responsibilities. His research topic focuses on advanced combustion concepts for compression ignition engines, including experimental and CFD modelling activities. Dr. Novella has participated in more than 40 projects funded by public institutions or by top industry enterprises. The quality of his research is supported by more than 30 publications in scientific journals and 15 international conference papers.

REGISTRATION FEES (Euros)

ILASS 2017 participants of any type	300€
UPV students and UPV members	300€
Academic non-UPV (tenure, post-doc, researcher)	500€
Industry participants and general public	600€

The fees include lunches, social dinner on Monday evening and coffee breaks and a total of 15 elective hours including theoretical and practical lessons. Registration is open from 1st February 2017 to **30th June 2017**. Maximum number of participants: **40.**

TO REGISTER: Applicants should register online at

https://www.cfp.upv.es/formacion-permanente/inicio/curso_datos_n.jsp?cid=52099&hash=9c4f9c19c71e934f9c4a9743884a9e4a9e4a9e4e964d73&&idioma=en&sweb=true

More information about the course and ILASS2017 conference could be found on:

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