
Course Description and Aims

This short course has the aim to present the current understanding and state-of-the-art of atomization fundamentals, their realization in atomizer systems and their application in a wide variety of engineering branches, including spray drying, spray coating, spray cooling, fuel injection, etc.

These aspects are first addressed theoretically in terms of hydrodynamic instabilities of liquid jets and sheets – primary atomization. This is followed by considerations about the break-up of single droplets – secondary atomization. Engineering solutions for realizing the different atomization mechanisms are then presented.

The second day is devoted to experimental descriptors and diagnostics of sprays and droplets. Both non-optical and optical techniques are addressed. Focus is placed on drop size and velocity determination, but an overview is also given about more advanced techniques, allowing temperature and composition to be determined.

The third day presents possibilities for simulating atomization and spray processes. Modelling of primary atomization is discussed, as well as transport processes within sprays and spray/wall interactions.

The final day of the course covers a wide variety of applications and how spray systems have been developed and customized to meet specific requirements and constraints.

The program foresees intensive discussions between the participants and the lecturers and also among the participants. The aim is to address ongoing development and application problems suggested by the participants. Industrial exhibitors of atomization equipment and spray diagnostics will be available on the second day for demonstrations and discussions.

Who should attend?

This course is directed towards practicing engineers and researchers involved in R&D and the application of spray systems. For those with little previous background, the course begins with fundamentals of atomization and proceeds through theoretical, experimental, numerical and application topics.

Venue

*Technische Universität Darmstadt
Center of Smart Interfaces (Lichtwiese Campus)
Alarich-Weiss-Straße 10
64287 Darmstadt, Germany
www.csi.tu-darmstadt.de*

Participants should make their own accommodation arrangements. For a recommendation of hotels or further information, please refer to the course website or contact Ms. Monika Medina (medina@csi.tu-darmstadt.de).

Fees and Registration

Registration for this four-day short course can be made on the course website under:

www.csi.tu-darmstadt.de/kasi

The fee for participation is 1200 EUR and is VAT free according to §4 Nr. 22a UStG. A reduction of 50% applies to all further participants from the same institute of higher education. A charge of 50 EUR applied to cancellations up to the start of the course. The fee includes all documentation of the lectures, coffee breaks, lunches and a course dinner on the second day. Participation is limited to 40 people.

Short Course on Atomization and Sprays

February 15 - 18, 2016
Technische Universität Darmstadt
Darmstadt, Germany



Offered by the Center of Smart Interfaces
www.csi.tu-darmstadt.de/kasi

Lecturers

Prof. Dr. Dieter Bothe

heads the Institute of Mathematical Modeling and Analysis at the Center of Smart Interfaces, TU Darmstadt

Prof. Dr.-Ing. Günter Brenn

heads the Institute of Fluid Mechanics and Heat Transfer at the TU Graz

Prof. Dr.-Ing. Joachim Domnick

heads the Surface Technology Lab at the Hochschule Esslingen

Dr.-Ing. Christoph Hassa

heads the combustor research at the DLR Institute of Propulsion Technology, Cologne

Prof. Dr.-Ing. Udo Fritsching

heads the group Multiphase Flow, Heat- and Mass Transfer at the IWT, University of Bremen

Dr.-Ing. Philipp Leick

Investigates the fundamentals of fuel injection processes at the Bosch central research laboratories in Renningen

Prof. Fabrice Lemoine

heads the Laboratoire d'Energétique et de Mécanique Théorique et Appliquée at the Université de Lorraine, Nancy

Priv.-Doz. Dr. Ilia V Roisman

is a senior researcher at the Institute of Fluid Mechanics and Aerodynamics at the TU Darmstadt

Prof. Eran Sher

Faculty of Aerospace Engineering, Technion – Israel Institute of Technology

Prof. Dr.-Ing. Peter Stephan

heads the Institute of Technical Thermodynamics at the TU Darmstadt

Prof. Dr.-Ing. Cameron Tropea

heads the institute of Fluid Mechanics and Aerodynamics at the TU Darmstadt

Prof. Dr. techn. Peter Walzel

heads the Institute of Mechanical Process Engineering at the TU Dortmund

Prof. Dr.-Ing. Bernhard Weigand

heads the Institute of Aerospace Thermodynamics at the University of Stuttgart

Day 1: Fundamentals

- 8:30 Registration, Distribution of Lecture Notes
9:00 Welcome, Introductions, Overview of the Course (*Tropea*)
9:30 Techniques of Atomization: Overview of Atomizers and Their Applications (*Tropea*)
10:30 Coffee
11:00 Fluid Mechanic Fundamentals (*Brenn*)
12:00 Lunch
13:00 Design of spraying devices I (*Walzel*)
13:45 Fundamentals of Atomization (*Roisman*)
14:30 Coffee
15:00 Heat and Mass Transfer Drops (*Brenn*)
15:45 Secondary Atomization (*Roisman*)
16:30 Discussion of Participant Cases
17:30 Close of First Day with Beer and Pretzels
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Day 2: Modeling and Simulation

- 9:00 Fundamentals of Modelling (*Roisman*)
9:45 A Survey on Direct Numerical Simulation Methods for Multiphase Flows (*Bothe*)
10:30 Coffee
11:00 Direct Numerical Simulation of Primary Jet Breakup (*Weigand*)
12:30 Lunch
13:30 Volume-of-Fluid Method for Multiphase Flows (Bothe)
14:15 Drop-Drop Interactions (*Brenn*)
15:00 Coffee
15:30 Drop/Wall Interaction (*Roisman*)
16:15 Spray/Wall Interaction (*Tropea*)
17:00 Close of Second Day
19:00 Short Course Dinner
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Day 3: Characterisation and Diagnostics

- 9:00 Spray Characterisation – Quantifiers and Standards (*Tropea*)
9:45 Imaging Techniques (*Leick*)
10:30 Coffee
11:00 Laser Diffraction Techniques (*Domnick*)
11:30 Phase Doppler Techniques (*Tropea*)
12:30 Lunch
13:30 Other Optical Techniques (*Tropea*)
14:15 Measurement of Drop Temperature and Composition (*Lemoine*)
15:15 Coffee
15:45 Characterization of Droplet Drying (*Brenn*)
16:30 Powder production in spray processes (*Fritsching*)
17:15 Assorted Solids and Fluids Exhibition of Spray Equipment and Spray Diagnostic Equipment (also during lunch and second coffee break)
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Day 4: Applications & Advanced Topics

- 9:00 Droplet Impingement Cooling with Evaporation (*Stephan*)
9:45 Flash Boiling Atomization (*Sher*)
10:30 Coffee
11:00 Atomizers for Fuel Injection (*Leick*)
11:45 Design of spraying devices II (*Walzel*)
12:30 Lunch
13:30 Spray Painting (*Domnick*)
14:15 Air-Blast Atomizers and their Applications (*Hassa*)
15:00 Close of Short Course
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