
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 on-going development and application problems suggested by the participants. Industrial exhibitors of 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*

Fees and Registration

The registration fee is:

- Industry: 1200 EUR
- Academia: 900 EUR

Fee is VAT free according to §4 Nr. 22a UStG. The fee includes all documentation of the lectures, coffee breaks, lunches and a course dinner on the third day. Participation is limited to 40 people.

Registration for this four-day short course can be made online from November 2017 on the course website under:

www.tfi.tu-darmstadt.de/as2018

For further information, please refer to the course website or contact Ms. Monika Medina (medina@tfi.tu-darmstadt.de).

Short Course on Atomization and Sprays

February 19-22, 2018
Technische Universität Darmstadt
Darmstadt, Germany



Offered by the profile area Thermo-Fluids & Interfaces in cooperation with DFG SFB/TRR 75
www.tfi.tu-darmstadt.de

Lecturers

Prof. Dr. Nasser Ashgriz

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr. Dieter Bothe

Institute of Mathematical Modeling and Analysis,
TU Darmstadt

Prof. Dr.-Ing. Günter Brenn

Institute of Fluid Mechanics and Heat Transfer,
TU Graz

Prof. Dr. Sanjeev Chandra

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr.-Ing. Udo Fritsching

Group leader Multiphase Flow, Heat- and Mass Transfer at the IWT,
University of Bremen

Dr.-Ing. Philipp Leick

Engineering Combustion System,
Robert Bosch GmbH Stuttgart

Prof. Fabrice Lemoine

Laboratoire d'Énergétique et de Mécanique Théorique et Appliquée,
Université de Lorraine, Nancy

Prof. Dr. Ilia V. Roisman

Senior researcher at the Institute of Fluid Mechanics and
Aerodynamics, TU Darmstadt

Prof. Eran Sher

Faculty of Aerospace Engineering,
Technion – Israel Institute of Technology

Prof. Dr.-Ing. Peter Stephan

Institute of Technical Thermodynamics, TU Darmstadt

Prof. Dr.-Ing. Cameron Tropea

Institute of Fluid Mechanics and Aerodynamics, TU Darmstadt

Prof. Dr. techn. Peter Walzel

Retired as head of the Institute of Mechanical Process Engineering,
TU Dortmund

Prof. Dr.-Ing. Bernhard Weigand

Institute of Aerospace Thermodynamics, University of Stuttgart

Prof. Dr. Alexander L. Yarin

Department of Mechanical and Industrial Engineering,
University of Illinois at Chicago

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 Stability Analysis of Liquid Jets and Sheets (*Brenn*)
12:00 Lunch
13:00 Design of Spraying Devices I (*Walzel*)
13:45 Fundamentals of Atomization (*Roisman*)
14:30 Coffee
15:00 Design of Spraying Devices II (*Ashgriz*)
15:45 Secondary Atomization (*Roisman*)
16:30 Drop-Drop Interactions (*Brenn*)
17:15 Close of First Day with Beer and Pretzels
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Day 2: Characterization and Diagnostics

- 9:00 Spray Characterization – Quantifiers and Standards (*Tropea*)
9:45 Imaging Techniques (*Leick*)
10:30 Coffee
11:00 Phase Doppler Techniques (*Tropea*)
12:00 Lunch
13:00 Other Optical Techniques (*Tropea*)
13:45 Measurement of Drop Temperature and Composition (*Lemoine*)
14:45 Coffee
15:15 Atomization of Highly Viscous Liquids (*Ashgriz*)
16:00 Atomization of Complex Fluids (*Brenn*)
16:45 Flash Boiling Atomization (*Sher*)
17:30 Close of Second Day
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Exhibition of spray diagnostic equipment during lunch and coffee breaks

Day 3: Modeling and Simulation

- 9:00 Direct Numerical Simulation of Primary Jet Breakup (*Weigand*)
10:30 Coffee
11:00 A Survey on Numerical Simulation Methods for Multiphase Flows (*Bothe*)
11:45 Volume-of-Fluid Method for Drop Collision (*Bothe*)
12:30 Lunch
13:30 Fundamentals of Modelling (*Yarin*)
14:15 Heat and Mass Transfer from Drops: Fundamentals (*Brenn*)
15:00 Coffee
15:30 Powder Production in Spray Processes (*Fritsching*)
16:15 Drop Combustion (*Sher*)
17:00 Case Studies in Atomizer Design (*Walzel*)
17:45 Close of Third Day

19:00 Short Course Dinner
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Day 4: Applications & Advanced Topics

- 9:00 Atomizers for Fuel Injection (*Leick*)
10:00 Drop/Wall Interactions (*Yarin*)
10:45 Coffee
11:15 Spray Painting (*Chandra*)
12:00 Atomization in Forensic and High Power Applications (*Yarin*)
12:45 Lunch
13:45 Spray Coating (*Chandra*)
14:30 Droplet Impingement Cooling with Evaporation (*Stephan*)
15:15 Spray Cooling (*Roisman*)
16:00 Close of Short Course
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