
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 discussions among the participants and the lecturers. The aim is to address on-going development and application problems suggested by the participants.

Who should attend?

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

Venue

Lectures will be aired using WebEX, either live or recorded. In either case, the lecturer will be available during the lecture period and questions and discussions with lecturers will be moderated through the chat function.

Course Fees and Registration

- Industry: 200 EUR
- Academia: 100 EUR

Course fees are VAT exempt according to article 132 (i) Council Directive 2006/112/EC. Included is live and download access to all lectures during the week and all accompanying documentation (slides).

Registration for this four-day short course can be made online from December 2020 on the course website:


www.tfi.tu-darmstadt.de/as2021

For further information, please refer to the course website or contact Prof. Cameron Tropea:

ctropea@sla.tu-darmstadt.de

Short Course on Atomization and Sprays

22 – 25 February 2021
Technische Universität Darmstadt
Darmstadt, Germany



Offered by the Profile Area Thermo-Fluids & Interfaces
in cooperation with DFG CRC/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

Department Multiphase Flow, Heat- and Mass-Transfer,
Leibniz Institute for Materials Engineering (IWT) Bremen

Dr.-Ing. Philippe Leick

Engineering Combustion System,
Robert Bosch GmbH Stuttgart

Prof. Fabrice Lemoine

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

Prof. Dr. Ilia V. Roisman

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Eran Sher

Faculty of Aerospace Engineering,
Technion – Israel Institute of Technology

Prof. Dr.-Ing. Peter Stephan

Institute for Technical Thermodynamics,
TU Darmstadt

Prof. Dr.-Ing. Cameron Tropea

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Dr.-Ing. Bernhard Weigand

Institute of Aerospace Thermodynamics (ITLR),
University of Stuttgart

Prof. Dr. Alexander L. Yarin

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

Monday 22 February 2021

Fundamentals

- 8:45 Session open for joining**
9:00 Welcome, Introductions, Overview, Use of WebEX and guidelines for discussions (*Tropea*)
9:30 Techniques of Atomization: Overview of Atomizers and their Applications (*Tropea*)
10:30 Screen break
10:45 Stability Analysis of Liquid Jets and Sheets (*Brenn*)
12:00 Screen break (Lunch)
12:30 Fundamentals of Atomization (*Roisman*)
13:30 Screen break
13:45 Breakup and Atomization Models (*Ashgriz*)
15:00 Screen break
15:15 Secondary Atomization (*Tropea*)
16:00 Screen break
16:15 Flash Boiling Atomization (*Sher*)
17:00 Close of first day
-

Tuesday 23 February 2021

Characterization and Diagnostics

- 8:45 Session open for joining**
9:00 Spray Characterization – Quantifiers and Standards (*Tropea*)
9:45 Imaging Techniques (*Leick*)
10:30 Screen break
10:45 Measurement Techniques (*Tropea*)
11:45 Screen break
12:00 Measurement of Drop Temperature and Composition (*Lemoine*)
13:00 Screen break (Lunch)
13:30 Nozzle Designs and their Spray Characteristics (*Ashgriz*)
14:30 Screen break
14:45 Droplet Impingement Cooling with Evaporation (*Stephan*)
15:30 Screen break
15:45 Fundamentals of Modelling (*Yarin*)
16:30 Close of Second Day
-

Wednesday 24 February 2021

Modeling and Simulation

- 8:45 Session open for joining**
9:00 Direct Numerical Simulation of Primary Jet Breakup (*Weigand*)
10:30 Screen break
10:45 A Survey on Numerical Simulation Methods for Multiphase Flows (*Bothe*)
11:30 Volume-of-Fluid Method for Drop Collision (*Bothe*)
12:15 Screen break (Lunch)
12:45 Heat and Mass Transfer from Drops: Fundamentals (*Brenn*)
13:30 Screen break
13:45 Drop/Wall Interactions (*Yarin*)
14:45 Screen break
15:00 Atomization in Forensic and High Power Applications (*Yarin*)
15:45 Screen break
16:00 Spray Painting (*Chandra*)
16:45 Close of Third Day
-

Thursday 25 February 2021

Applications & Advanced Topics

- 8:45 Session open for joining**
9:00 Atomizers for Fuel Injection (*Leick*)
10:00 Screen break
10:15 Drop Combustion (*Sher*)
11:00 Screen break
11:15 Atomization of Complex Fluids (*Brenn*)
12:00 Screen break (Lunch)
12:30 Powder Production in Spray Processes (*Fritsching*)
13:30 Screen break
13:45 Spray Coating (*Chandra*)
14:30 Screen break
14:45 Spray Cooling (*Roisman*)
15:30 Close of Short Course
-