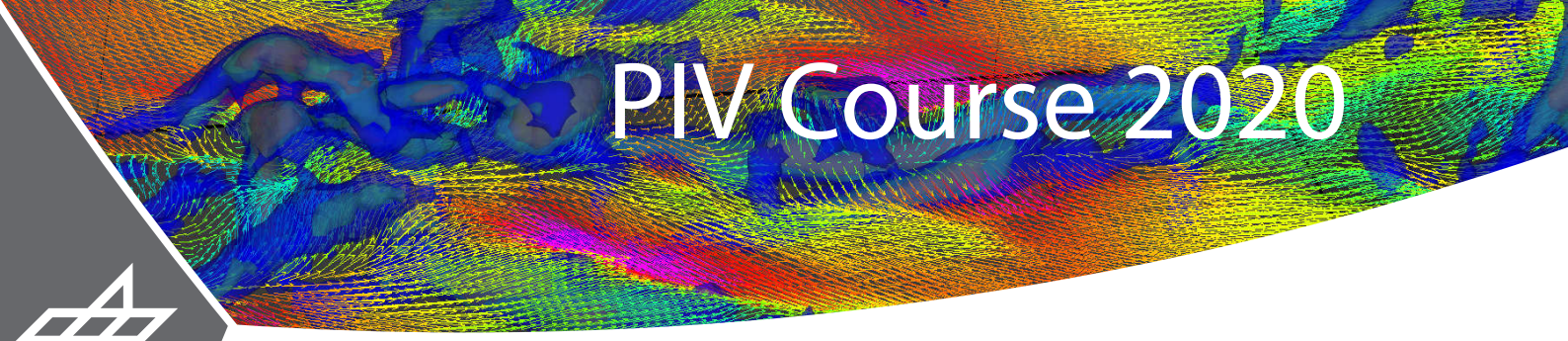


PIV Course 2020

DLR

Application of Particle Image Velocimetry Theory and Practice, March 16 -20, 2020

Application of PIV

The main interest of today's research in fluid mechanics is more and more directed to problems where unsteady and separated flows are predominant. For investigations of flow fields with pronounced spatial structures and/or rapid temporal or spatial changes (transition from laminar to turbulent flow, coherent structures, pitching airfoils in transonic flows with shocks, rotors, test facilities with short run time, etc.) optical experimental techniques, such as Particle Image Velocimetry (PIV) and Lagrangian Particle Tracking (LPT) are required which allow to capture the flow velocity of large flow fields instantaneously. An important feature of PIV and LPT is that a reliable basis of experimental flow field data is provided for direct comparison with numerical calculations and hence, for validation of flow simulation codes. During the last years an increasing number of scientists have started to utilize the PIV techniques to investigate the instantaneous structure of velocity fields in various areas of fluid mechanics. A large number of different approaches for the recording and evaluation of PIV images have been described in literature. This course, which is the 28th course on PIV since 1993 organized by DLR, will mainly concentrate on those aspects of the theory of PIV relevant to applications. Besides giving lectures on the fundamental aspects, special emphasis is placed on the presentation of practical and reliable solutions of problems which are faced during the implementation of this technique in wind tunnels and other test facilities. During practice the participants will have the opportunity to carry out the recording and the evaluation of PIV images by themselves in small groups. Matured developments of the PIV technique such as Stereo PIV, Time Resolved PIV, Micro-PIV and recent innovations in 3D(t)-PIV/3D-PTV (tomographic and digital holographic PIV, LPT Shake-The-Box) will be discussed and demonstrated.

Program Schedule

Registration will begin at 8:00 on Monday, March 16, 2020 in the Foyer of Building 7. Lectures (4 half days) will be given from Monday to Wednesday beginning at 8:30. Experiments and demonstrations in the laboratory (5 half days) will run from Tuesday to Friday, respectively. All presentations will be given in English.

Course registration

Early registration is required due to limited number of places in the laboratory. Only online registration is possible opening mid of October 2019 at:

http://pivcourse.dlr.de.

The registration fee of 1450 € includes course notes, lunches and refreshments during the course. For payments received before January 31, 2020, a reduced registration fee of 1350 € applies. The fee for participation is free of VAT as far as the German Umsatzsteuergesetz (UStG) is concerned. The organizers reserve the right to cancel the course in case of insufficient registration. A cancelation fee of 300 € will be charged from registered persons who cancel their participation after February 28, 2020.

Course materials

A complete set of course notes together with the book 'Particle Image Velocimetry - A Practical Guide (3rd Edition)', newly published by Springer (2018) and the USB-Stick of proceedings of the PIV'19 symposium will be distributed to the participants at registration.

Who should attend?

This course is mainly intended for engineers, scientists and students, who have already some basic knowledge of the PIV technique and have just started to utilize PIV or LPT for their special industrial or scientific applications or plan to do so in near future. During the course many problems arising in the recording and evaluation of PIV and LPT images will be treated - in theory as well as in practice.

Organized by:

AG STAB

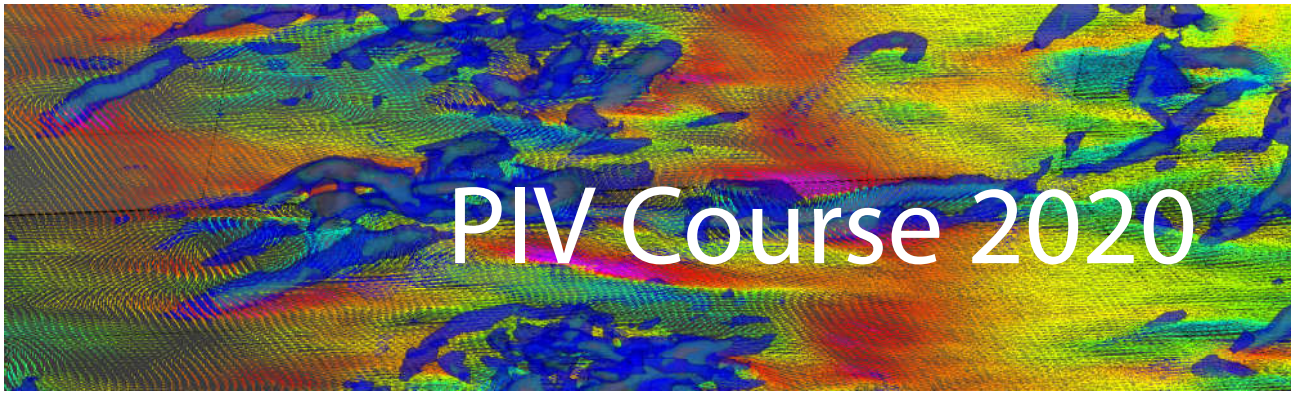
STAB

J.M.Burgerscentrum
Research School for Fluid Mechanics

In cooperation with:

Delft University of Technology,
University BW of Munich,
University of Rouén (CORIA-CNRS),
University of Oldenburg

DLR, Göttingen



Lecture outline

March 16, 2020, 08:00-16:30
Registration 08:00-08:30. Welcome by Dr. Lars Koop, Head of Experimental Methods. Principles of PIV: Flow tracing by particle imaging, light scattering, recording of PIV images, analysis. Application of PIV: Considerations for design of PIV-systems, PIV systems for wind tunnels. Principles: Statistics of PIV images. Welcome party 17:30.

March 17, 2020, 08:30-16:30
Application: Digital PIV, video recording, CCD/CMOS sensors. Principles: Theoretical aspects of evaluation of digital PIV recordings, cross-correlation, image deformation, peak detection, evaluation of stereoscopic PIV recordings. Application: Practical aspects of evaluation of digital PIV recordings, measurement uncertainties, Combined PIV / LIF. Practice I.

March 18, 2020, 08:30-16:30
Principles: Advanced techniques, optical principles of stereoscopic, tomo- and holographic, Shake-The-Box methods, FlowFit, data validation. Application: Multi plane stereo-, Micro- and Time Resolved–PIV, STB, PIV for multiphase flows, vector field operators, data analysis and presentation. Practice II.

March 19, 2020, 08:30-16:30
Practice III and Practice IV. Dinner 19:30

March 20, 2020, 08:30-12:30
Practice V. Future aspects of PIV /PTV /STB. Final discussion.

Preliminary practice outline

I - Optics: imaging, laser illumination, Fourier. Background oriented Schlieren (BOS)
II - Image capture in wind tunnel: seeding, laser, optics, triggering, sCMOS recording, optical distortions, Stereo-PIV.
III - Image capture for large scale water flows: Pulsed LEDs, CMOS high-speed-recording, Shake-The-Box)
IV - Evaluation and post processing: cross-correlation methods, data validation, data analysis and presentation.
V - PIV related techniques: video stroboscope, sequencer technique.
(Digital) Holographic PIV.

Exhibition

An exhibition of equipment from major manufacturers of PIV systems will take place from March 19 to 20, 2020.

Lecturers

Prof. Jerry Westerweel, Delft University of Technology (TUD), The Netherlands, will discuss the theoretical basis of the digital PIV technique.
Prof. Christian Poelma, TUD, will discuss combined PIV/LIF and Micro PIV in his lectures.
Prof. Christian Kähler, UniBw München will discuss Stereo and Multi-plane PIV aspects and the advances in Time Resolved- and long range micro-PIV.
Dr. Bertrand Lecordier, Rouen University (CORIA), France, will present the lectures on the optical aspects of PIV.
Dr. Gerd Gülker, Carl von Ossietzky Universität, Oldenburg, Germany, is working in the field of Holography and Particle Image Velocimetry and will present the lectures on advanced 3D PIV techniques.
Prof. Andreas Schröder, Institute of Aerodynamics and Flow Technology, DLR, Göttingen, will organize the PIV course, which was established in 1993 by Dr. Jürgen Kompenhans. In the past Prof. Markus Raffel and Dr. Christian Willert have provided the foundations of PIV application in wind tunnels.
Together with Prof. Markus Raffel, Dr. Chris Willert, Dr. Klaus Ehrenfried, Dr. Boleslaw Stasicki, Dr. Reinhard Geisler, Dr. Daniel Schanz, Dr. Matteo Novara, Dr. Sebastian Gesemann, Dipl.-Ing. Janos Agocs and Dr. Christian Wolf from DLR they will present their knowledge and experience in different areas of the PIV and LPT technique such as tracer particles, illumination, recording, evaluation, data presentation, 3D(t)-PIV / PTV / STB, FlowFit and other 3C-PIV techniques.

Additional information

For additional information about the course contact:

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