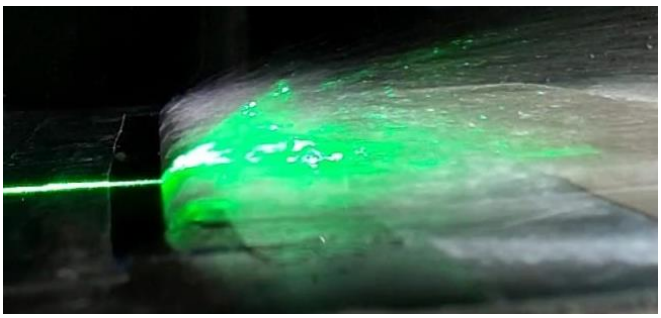
Technische Universität Braunschweig

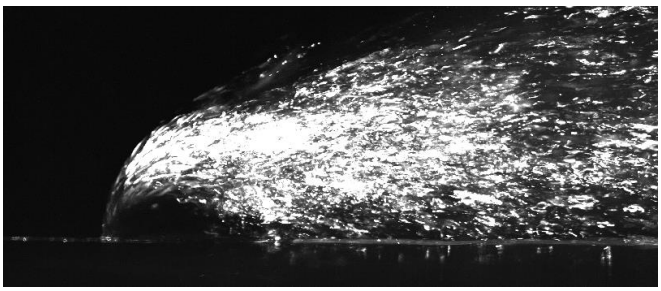
Institute of Fluid Mechanics

SE²A

Evaluation of measurement techniques to capture the shape and velocity of a water jet in air crossflow

Project Description





Figures: Water jet experiments in crossflow

Gusts and flight maneuvers cause dynamic loads on aircraft wings that reduce passenger comfort and lead to mechanical deformations of the wings. To counteract these deformations, the wings can either be designed to be stiffer (and thus heavier), or the dynamic loads can be counteracted directly, thereby reducing weight and fuel consumption. In addition to the currently implemented load reduction approaches based on conventional flap systems, novel concepts are currently being investigated that use fluidic flow actuators distributed over the entire wing span. These systems can alter the spanwise lift distribution and have the potential to respond quickly and efficiently to gust and maneuver loads. Compressed air is usually used as the working fluid in these fluidic actuators. However, future short- and medium-range air-craft powered by fuel cells will produce large amounts of water (about 4000-8000 liters per hour) as a byproduct of power generation, which could also be used for flow actuation. A previous student thesis investigated the use of water jets for lift modification on a wind tunnel model, see figures above. It found that the utilized finite blowing slot lengths produced highly three-dimensional and unsteady water jets. Measuring the geometries and the corresponding flow velocities in these jets is relevant to characterize the effects of the jets on the aerodynamic performance of the actuated wing, but quite challenging due to restricted optical access, the reflective water surfaces and formation of water droplets during break-up of the jet sheet. This thesis aims to evaluate and test different measurement techniques in order to capture the shape and velocity of a water jet in air crossflow. Depending on the selected measurement methods, a range of optical measurement equipment including high-speed cameras and lasers for illumination, as well as different wind tunnel facilities are available for this project.

Requirements

- Solid background in fluid mechanics
- Proficiency in written and spoken English
- Basic knowledge in Matlab or Python
- Experience with flow measurement techniques is a plus, but not a requirement

Contact information

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Candidates with handicaps will be preferred if equally qualified. Please enclose a proof. The position is part of the SE²A International Female Programme, so only applications by female students of non-German universities are possible. Applications from people of all nationalities are welcome. Please note that application costs cannot be refunded.

The personal data will be stored for the purpose of processing the application. By submitting your application, you agree that your data may be stored and processed electronically for application purposes in compliance with the provisions of data protection law. Further information on data protection can be found in our data protection regulations at https://www.tu-braunschweig.de/datenschutzerklaerung-bewerbungen.