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Particle image velocimetry in fuel sprays: An experimental approach

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Fuel sprays are commonly produced by increasing the relative velocity between liquid and gaseous phases. Particle-Image-Velocimetry (PIV) is a well-established technique for velocity analysis in multi-phase flows. We can perform PIV by illuminating the particles with a short light pulse, typically a laser pulse, which produces a set of successive digital images. Then, image-processing functions correlate these images to produce velocity vector fields. However, there are many factors to be considered during PIV experiments, including the particle size, pulse-width of the fluid injector imaging angle, and the size of the interrogation window, amongst other factors. Planning ahead and understanding your experiment's requirements could save valuable time and resources. In this paper, we present a few steps for researchers planning to perform PIV experiments in fluid sprays. We discuss factors that affect the quality of the vector field results. We also show the light-scattering (Mie scattering) efficiency of fluid particles and how it is affected by both average particle size and imaging angle. Then we present a case study of a VHS fuel injector for small rotary engines. We show the experimental setup, the analysis procedure, and the results of applying PIV on jet fuel sprays. Our results include vector fields of small droplets (less than 50 microns in diameter) produced by micro-PIV tracking technique and shadowgraph images.

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Engineering student project teams: A microcosm of the college/university

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Cornell Engineering has been a worldwide leader in the development of experiential learning for over 30 years. To spring-off of Ezra Cornell's "I would found an institution where any person can find instruction in any study", we encourage "any student…any project…" to occur. As we continue to aspire to make discoveries and educate leaders who will change the world, greater attention has been given to the engineering student project teams. Ultimately, this led to the development of a program level position with coordination throughout the College of Engineering. The primary focus of the program is to provide opportunities for students across all engineering and related disciplines to participate in hands-on interdisciplinary design, development, and construction of novel methods and/or projects. Students use their technical knowledge, creativity, entrepreneurism, and leadership skills to engage in national and international competitions and service projects. Currently, twenty-four teams are registered with nearly 1100 student participants representing every undergraduate engineering degree as well as from all colleges at the University. A qualitative and quantitative study was undertaken to better understand the breadth and impact of the current program. Along with anecdotal comments, the following categories will also be addressed: gender, class rank, ethnicity, project type, budgets, travel, course credit, etc. This will establish a baseline for the program that can be measured against for future growth, needs or interests, and decision making as well as a case study for other programs.

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