CEE618/ME964B
Advanced Measurement Techniques in Fluid Dynamics

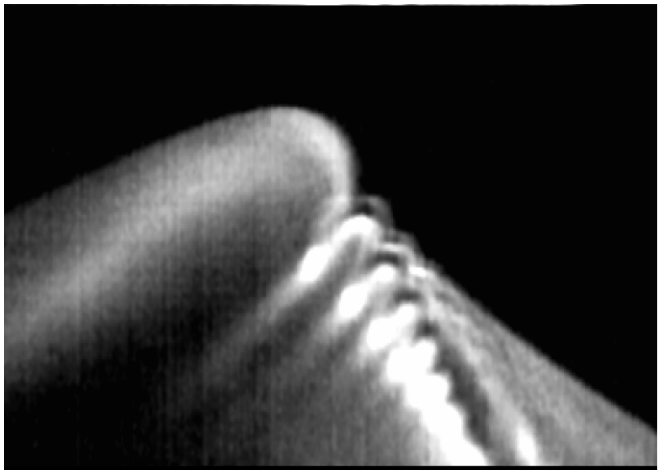
Instructors: Professors Chin Wu, John Hoopes, and Tim Shedd
Time and Location: 11:00 – 11:50 am, Monday (lecture) – EH1213
1:20 – 4:20 pm, Friday (Lab) – EH1269 and ME118

Goals:

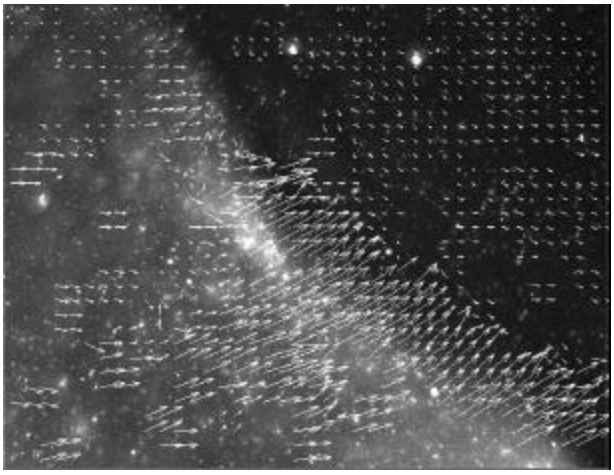
1. Prepare individuals to apply advanced experimental research techniques to the study of complex fluid flows and phenomena through measuring and analyzing laboratory observations of basic fluid flows and phenomena.
2. Improve writing skills through reports of the measurements and analyses.

Objectives:

1. Introduce the theoretical principles for and the instrumentation and methods of measurement and data storage/analysis for various physical quantities (e.g.,velocity, concentration, particles) and phenomena (e.g., diffusion, turbulence, boundary layer).
2. Apply the instrumentation/methods to the measurement and data analysis of simple fluid flows and phenomena (e.g., velocity distribution and diffusion in wall bounded and free shear flows).
3. Write short reports to present and explain the instrumentation and measurements. The purpose of this course is 1) to prepare you to apply advanced experimental research techniques to the study of complex fluid flows and 2) to give you a more intuitive, in-depth understanding of fluid dynamics behavior through hands-on laboratory experience.



Capillary waves on a spilling breaker



Velocity vectors of flow in a shear wave crest

Course outline:

Lecture	*Lab*	
	Sept 3: Introduction to laboratory	H/S/W
Sept 6: No class	**Sept 10: DAQ/Uncertainty Analysis**	S
Sept 13: Flow visualization	**Sept 17: PLIF**	W
Sept 20: Dye (Transport processes)	**Sept 24: Dye (Transport processes)**	H
Sept 27: ADV	**Oct 1: ADV**	H
Oct 4: ADCP	**Oct 8: ADCP**	W
Oct 11: Hot-wire anemometers	**Oct 15: Hot-wire anemometers**	S
Oct 18: LDV	**Oct 22: LDV**	S
Oct 25: DPIV-I	**Oct 29: DPIV-I**	W
Nov 1: DPIV-II	**Nov 5: DPIV-II**	S
Nov 8: ADV/ABS	**Nov 12: ADV/ABS**	H
Nov 15: Imaging techniques	**Nov 19: Imaging techniques**	S
Nov 22: Web page design tutorial	**Nov 26: No class**	S
Nov 29: On-site project	**Dec 3: On-site project**	H/S/W
Dec 6: On-site project	**Dec 10: Class presentation**	H/S/W
Dec 13: Class presentation		H/S/W

Laboratory Assignments

You will be expected to prepare a short report (individually) for each laboratory experiment. This will be comprised of two parts:

a) An introduction, background and sample calculations section that will be due at the beginning of the laboratory session
b) A results, discussion/analysis and conclusion section that will be due the following class period

Please see the attached example report for details of suggested formatting and content.

The purpose of this report format is to allow you to master the content of material introduced in the class period before going into the lab and present your initial work in the first half of your report. It is *very important* that you do this, as many of the laboratory experiments are complex and an unprepared researcher will not obtain any useful results in the time allotted. The report grades will be weighted 50% for the pre-lab portion and 50% for the post-lab portion.

Attendance

This is a laboratory class with only one section. It is very important that you attend both the lecture and the laboratory section. Very rarely, extreme circumstances will arise that will make it impossible for you to attend class. Please speak with an instructor before missing class if at all possible. If you miss a class unexpectedly, please communicate with an instructor as soon as possible to see if any alternate arrangements can be made.

Final Projects

A final project will be required for this course. You will select the topic of the project and a partner to work with. A formal proposal for your project will be due on **Monday, November 8**. (Further instructions on proposal preparation will be provided.) We expect that your project will be directly related to your thesis research and will help you toward meeting your research objectives. You will present the results of your project on a web site that you will create and through oral presentations to the rest of the class.

Assessment:

Grades will be based on the following:

Laboratory Assignments	70 %
Final Project (web site and oral presentation)	30 %

Reference:

R. J. Goldstein, editor, *Fluid Mechanics Measurements*, Second Edition, Taylor & Francis, Washington, DC, USA, 1996.