A WEB-BASED PYTHON PIV ANALYSIS PROGRAM FOR USE IN UNDERGRADUATE LABORATORY EXPERIMENTS.

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1. Introduction and Aims

1.1. **Introduction.** The measurement of velocity is one of the most fundamental parts of fluid mechanical analysis. Flows are characterised by their velocity fields, and from the velocity of a fluid other dynamic parameters, such as pressure, energy losses, and density, can be readily determined. Many methods exist for measuring velocity, but many commonly used methods, such as pitot tubes, restriction plates, or turbine meters only measure velocity at a point or as an average across a section, and may affect flow up and downstream of the measurement device [1, pp. 109, 469]. These methods have the advantage of real-time measurement, but they cannot be used to determine the behaviour of a broader flow field within a flow: another method is required.

Particle Image Velocimetry (henceforth: PIV) is one such method. In PIV, marker objects – usually small spheres – with neutral buoyancy are introduced to the portion of the flow to be studied [3][1]. When appropriately sized for a specific flow, these particles will track the bulk motion – the advection – of the flow, with a high degree of accuracy. The velocity of the flow in the area around the particle – both magnitude and direction – can then be determined through photography over a known time interval.

This makes PIV a powerful analytical tool that is commonly used when studying flow profiles [CITE ME]. When many particles are used, the velocity at many points in a flow field can be measured at once
w. hat is particle image velocimetry how is it accomplished why is it useful why is the development of this technology useful in this context – undergraduate laboratory what is Dash why Dash? what should the finished product do?

1.2. **Aims.** Specifically, this project aims to:

- develop a useful and user-friendly PIV application. This will involve:
  - determining the specific requirements of the end user, deciding which features must be present and which features are simply nice-to-have, prioritising feature and product development.
  - Determining the hardware and software operating environment [2]
  - Determining the physical test equipment the software is to be used with [3]
  - Creating

References

[1] T. H. O. Bruce R. Munson, Donald F. Young, *Fundamentals of Fluid Mechanics, Fifth Edition.* Wiley, 2006.

[2] Wikipedia contributors, "Particle image velocimetry — Wikipedia, the free encyclopedia." `https://en.wikipedia.org/w/index.php?title=Particle_image_velocimetry&oldid=1012742345`, 2021. [Online; accessed 30-March-2021].

[1] While not appropriate for a more in-depth analysis, Wikipedia provides reasonably good high level summaries of most concepts and is cited here for this reason.

[3] WorkSafe Victoria, "Office work: Safety basics." https://www.worksafe.vic.gov.au/office-work-safety-basics, 2020. [Online; accessed 30-March-2021].