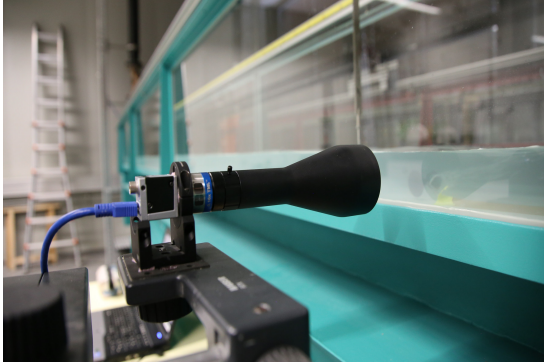


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Subject Area	Digital Image Processing
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Velocity Estimation with Digital Image Processing

How does a water current flow, and how can it's velocity be measured with optical methods.



Camera setup and measuring channel

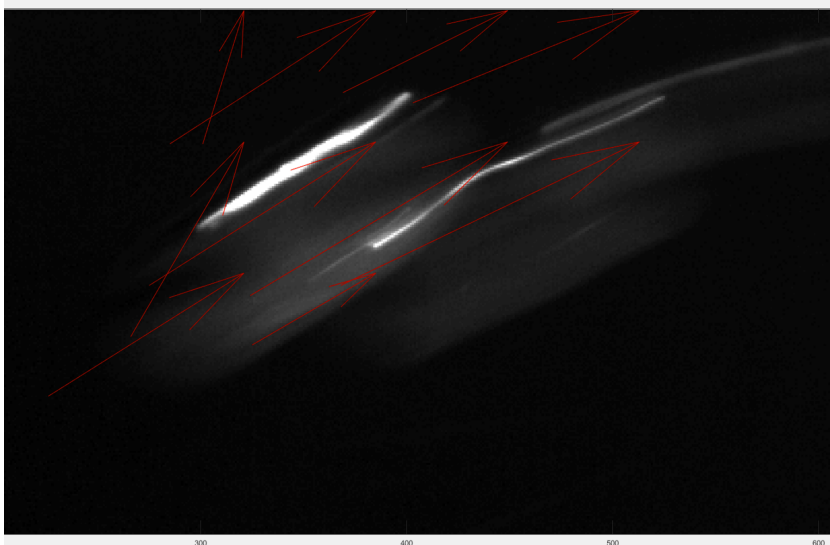


High speed camera from Basler AG

Introduction: In the department of flow calculation, the company from Baar called Rittmeyer is one of the leading providers. The water flow rate is measured by means of ultrasonic signals, which are sent through the water from transmitter to receiver. The parameter for calculating the speed is based on how long these signals travel. This method works very well for clear water. Although in the case of dim water, the signal is attenuated and the measurement can fail.

Objective: According to the understanding of the theoretical aspects of water flow, the speed must be measured with the camera. By recording a water current, and with the help of digital image processing, it's velocity can be estimated. One of the main questions is, can the velocity of water be measured precisely enough with a camera? And is the calculation as precise in dim as in clear water?

Solution: The University of Applied Science in Rapperswil has a measuring channel, where it was ideal to recreate a reproducible water current. Because of the channel being made out of glass, it was suitable to set up the camera on the side, and film the current's flow from there. The idea is to track the fluid's movement between the frames. Clear water on a film is almost invisible. Adding air bubbles into the water resulted in visible and trackable objects in the current. These air bubbles move with the speed of the current. Therefore by tracking these bubbles with the help of motion estimation, the velocity of the water current can be calculated.



Vectors calculated through motion estimation