The basic pattern matching principles behind Particle Image Velocimetry

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Particle Image Velocimetry (PIV) has over the course of the last two decades become the de-facto standard for measurements of velocity and deformation in laboratory experiments. As such, PIV presents two significant challenges to the user; the first is how to set up an experiment and acquire optimal images for the second step, which is the software challenge of pattern matching. We will review the history of PIV and the fundamental pattern matching principles the technique is built upon. The talk will present the basics and review common pitfalls and error sources such as sub-optimal patterns, two-phase flows and large local shears. The most common source of error is perhaps caused by sub-optimal images, where the images do not contain "enough pattern" or there is significant out-of-plane motion. We will present results showing the effect this has on rms-errors, a solution for reduction of these errors, as well as recent unpublished results from a more general pattern matching approach.