Prandlt's Flow Visualization Films meet Shake-The-Box

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We would like to report on the flow visualization techniques used in the 1920s up to 1930 at the Kaiser Wilhelm Institute for Aero and Hydrodynamics in Göttingen under the direction of L. Prandtl for the creation of film sequences visualizing various forms of flow separation in open-surface water channels. After first efforts with cinematography in the 1910s, Prandtl began to produce flow visualization films in the 1920s, in order to better capture the dynamics of the unsteady flow phenomena. However, due to the short exposure times provided by the film camera the particles appeared as dots rather than the anticipated streaks which were desired as representations of the streamlines. Therefore, Prandtl and his colleagues first worked with a modified camera to provide longer frame-exposure time and consequently streaked images. At this point, the real potential of animated film, for instance for the demonstration of flow separation, was realized and resulted in a flow visualization film, originally named "The Production of Vortices by Bodies Travelling in Water", that Prandtl showed 1927 in London and while travelling the globe from 1929 to 1930 [1]. The sequences of this film were found to be highly instructive from an educational point of view such that the film, now named C1, was made available in 1936 through the Reich Office for Teaching Films and in the 1950s by the Institute of Scientific Film. Additional sequences were recently found in the archives which are particularly well suited for quantitative evaluation with modern PIV correlation algorithms and tracking analysis methods such as the "shake-the-box" (STB) algorithm [2]. In our contribution we will highlight various aspects of the used facilities and experimental procedures and will provide an analysis of the available material from today's particle imaging perspective.

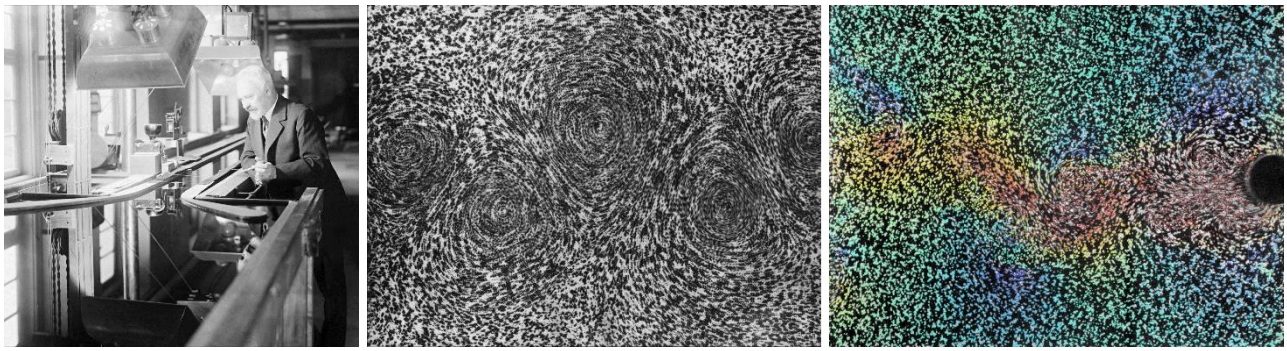

Fig.1: Left: photograph of Ludwig Prandtl next to a water flume at the "Kaiser Wilhelm Institute for Aero and Hydrodynamics" in Göttingen in 1925; middle: combined frame pair from a film sequence of a cylinder wake flow; right: particle field color-coded with velocity magnitude obtained with 2D-STB processing.

References

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