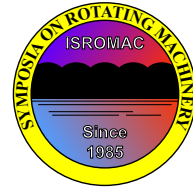


Experimental investigation on pump-intake-elbow systems using refraction index matching and TR-SPIV

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Long Abstract

Abstract

Most of the times pumps operate off best point states. Reasons are post changes of operating conditions, modifications, pollution and wearout or erosion. As consequences non-rotational symmetric flows, transient operational conditions, increased risk of cavitation, decrease of efficiency and unpredictable wearout can appear. Especially construction components of centrifugal pumps, in particular intake elbows, contribute to this matter.

Intake elbows causes additional losses and secondary flows, hence non-rotational velocity distributions as intake profile to the centrifugal pump. As a result the impeller vanes experience permanent changes of the intake flow angle and with it transient flow conditions in the blade channels.

This paper presents the first results of a project, experimentally investigating the consequences of non-rotational inflow to leading edge flow conditions of a centrifugal pump. Therefore two pump-intake-elbow systems are compared, by only altering the intake elbow geometry: a common single bended 90° elbow and a numerically optimized elbow (improved regarding rotational symmetric inflow conditions and friction coefficient). In addition the same measurements are carried out at the reference system consisting of pump with straight intake tube.

The experiments are performed, using time resolved stereoscopic PIV on a full acrylic pump with refractions index matched (RIM) working fluid. This allows transient investigations of the flow field simultaneously for all blade leading edges. Special focus is translated to the applied optical measurements technics inside the operating impeller.

Keywords: non-rotational symmetric inflow, centrifugal pump, intake elbow, PIV, RIM

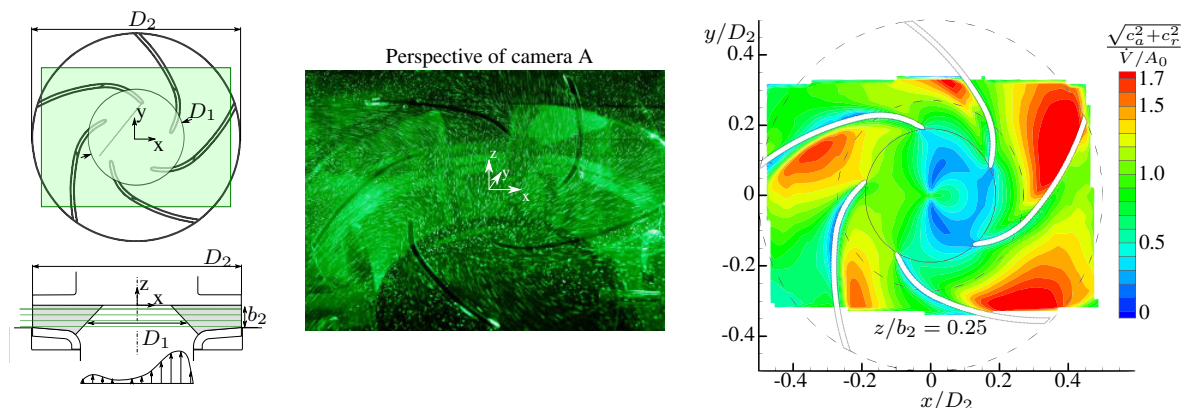


Figure 1. Measurement section and experimental results showing the flow field in the impeller