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OPTIMISATION OF A SINGLE-JET WATER METER'S SENSITIVITY BY CFD SIMULATIONS AND DESIGN OF EXPERIMENTS

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Sensitivity, i.e. the capacity of registering small flow rates, is one of the most significant characteristics required to water meters [1]. In this work, a computational parametric study is carried out in order to optimise the sensitivity of a commercial single-jet water meter by using Computational Fluid Dynamics (CFD) simulations combined with Design of Experiments and Response Surface methodologies [2]. Different design parameters have been considered with regard to the turbine, the chamber that house the turbine and the entry nozzle, which provides the main features of the jet.

The flow within the water meter was analysed by means of three-dimensional transient CFD simulations. The turbine´s instantaneous rotational speed has been calculated from its interaction with the flow by employing a semi-implicit coupling algorithm [3]. All the simulations are performed in laminar regime due to the small flow rates considered in the study.

The optimization strategy was conditioned by the industrial research project in which the work has been developed. Specifically, two design parameters were selected for the turbine, the entry nozzle and the chamber and they have been sequentially optimised instead of considering all the parameters at once. Full Factorial studies with a centre point were carried out for each pair of parameters. These studies have been enlarged to Central Composite Face Centred designs whenever a more reliable response surface was needed for optimization.

The most significant outcomes of the study are that 1-the geometrical design parameters having the largest influence on the water meter's sensitivity have been identified and 2-the sensitivity has been improved by modifying the design parameters in the way suggested by the optimization process.

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