Automatic Shape Optimisation in Hydraulic Machinery Using OpenFOAM

Dipl.-Ing. Jakob Simader, simader@ihs.uni-stuttgart.de **Dipl.-Ing. Andreas Ruopp**, ruopp@ihs.uni-stuttgart.de **Dipl.-Ing. Ralf Eisinger**, rei@ihs.uni-stuttgart.de **Dr. -Ing. Albert Ruprecht**, albert.ruprecht@ihs.uni-stuttgart.de	University of Stuttgart, Institute of Fluid Mechanics and Hydraulic Machinery, D-70550, Stuttgart, Germany

Abstract

Nowadays for common CFD the relation between the cost of needed hardware and the cost of commercial software changes towards the costs of software, especially regarding grid and parallel computing. In order to save computational time CFD driven 3D shape optimisation with a large number of parameters and grid sizes of about 1 million elements is only suitable by parallelising the optimisation and the CFD analysis. This paper proposes automatic optimisation of elbow draft tubes shapes using OpenFOAM in grid environment.

For the purpose of optimising various parts in hydraulic machinery an in-house algorithm of the Institute of Fluid Mechanics and Hydraulic Machinery, University of Stuttgart is developed which includes evolutionary theory, simplex algorithm and random function. Likewise a grid generator for parameterised elbow draft tubes is provided (Figure 1.).

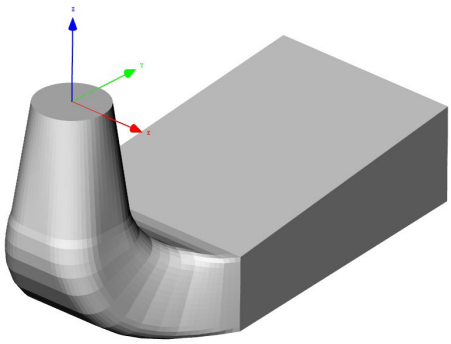

Figure 1.: elbow draft tube

Our automatic optimisation, with the parameterised elbow draft tube, is performed using OpenFOAM. The shape is optimised for three different operating points, optimum, part load and overload. The high number of parameters and the different operating points would lead to high calculation times while calculating each individual one by one. Hence, the optimisation chain distributes several individuals on cluster nodes at the same time and the optimisation is done massively parallel.