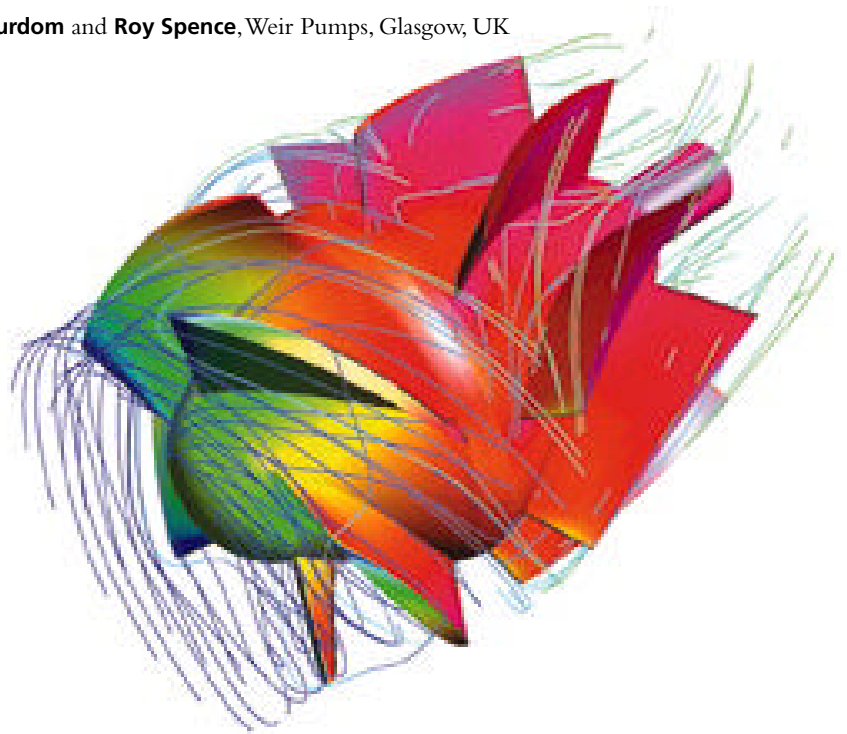


Improved design for mixed-flow pumps

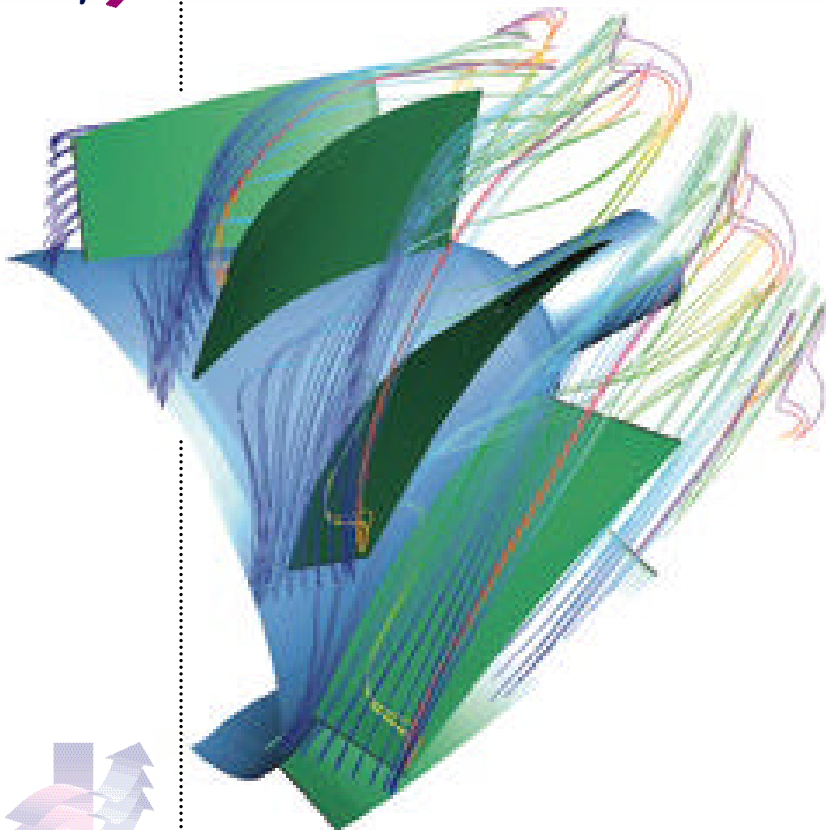
by **David Burt**, AEA Technology, **Tom Purdom** and **Roy Spence**, Weir Pumps, Glasgow, UK

At Weir Pumps, CFX-TASCflow is an integral part of the design process. A typical application included confirmation of the final design of a mixed-flow bowl pump with an open impeller and vaned diffuser. Weir Pumps used CFX-TurboGrid to generate the meshes and the frozen rotor technique to model the interaction between the impeller and the diffuser. In order to test the sensitivity of the machine to tip clearance, calculations were performed for a variety of tip gaps.

Results for the analysis of the whole machine were compared with experiment, both for the gross parameters of head versus flow and for more detailed measurements of local axial velocity from LDA data. The calculations showed that separation off the suction side of the diffuser blade was responsible for the bulk of the losses in the machine at low flow rates.



Static pressure on the surfaces and streak lines indicating the flow path at 59% of designed flow



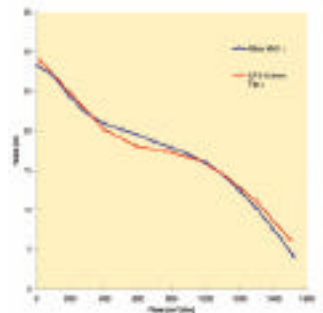
Streak lines showing the separation and recirculation off the suction side of the diffuser blades at the 59% flow condition

Ideally the pump should have a constantly rising head flow curve across the range of operation. In the original design the head flow curve was seen to be unstable at reduced flow, leading to problems when operating machines in parallel or while bringing the machine up to load. By looking at the individual component characteristics it was possible to identify a steeply rising loss characteristic for the diffuser in a region where the impeller characteristic was relatively flat.

CFX-TASCflow confirmed that the final design was improved by reducing the impeller best efficiency flow to give a steeper gradient in the impeller performance curve and a reduced power requirement across the affected range.

This work clearly shows the importance of component interaction in the performance of rotating machinery, and confirms that CFD can be relied upon to predict this

accurately. A paper discussing these results in more detail will be presented at the IMechE seminar on the use of CFD in Fluid Machinery Design (S546), taking place at the IMechE headquarters in London on Thursday 15th October, 1998.



Head flow characteristic for the improved design

This work clearly shows the importance of component interaction in the performance of rotating machinery, and confirms that CFD can be relied upon to predict this accurately

