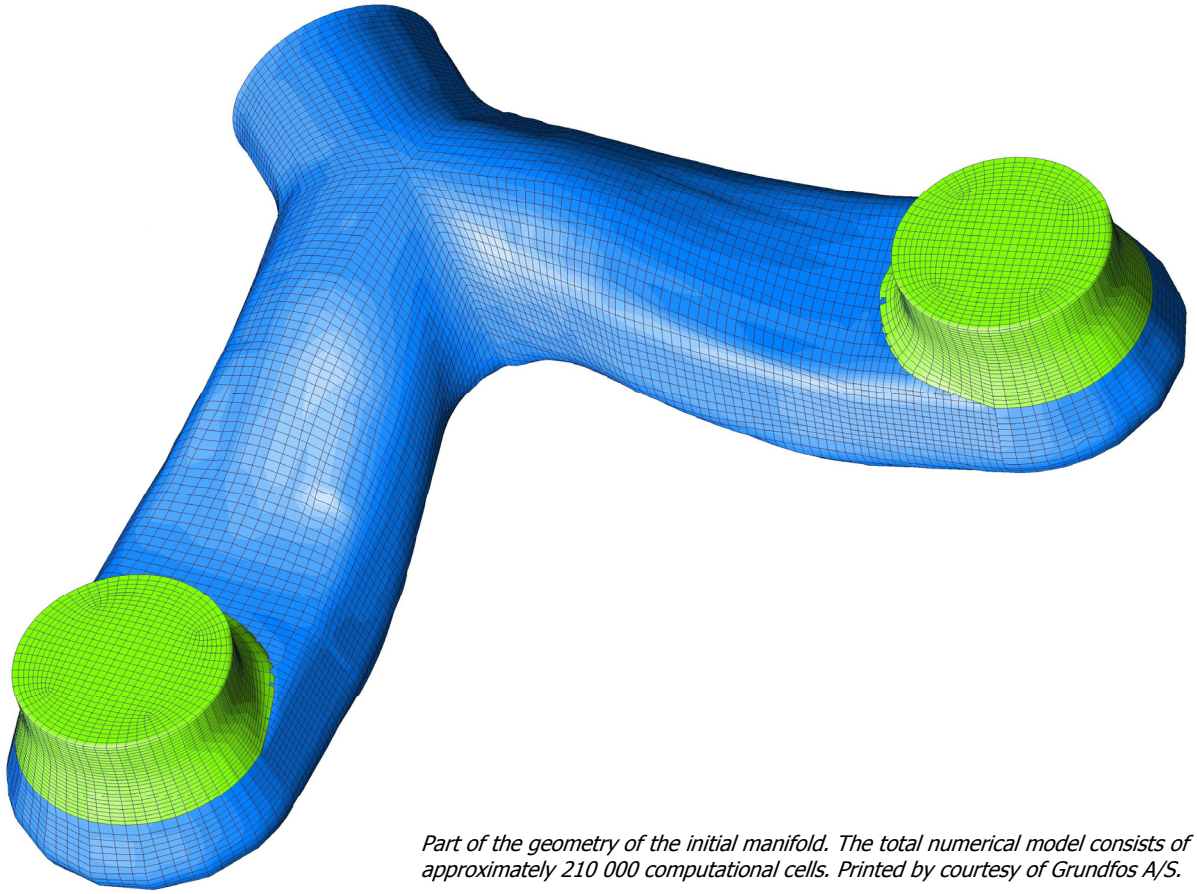
Flow Optimisation in an Inlet Manifold for a Twin Pump

Flow Optimisation



Part of the geometry of the initial manifold. The total numerical model consists of approximately 210 000 computational cells. Printed by courtesy of Grundfos A/S.

The objective of the project was to optimise the flow in an inlet manifold for a twin pump. The flow optimisation was carried out in co-operation with Grundfos A/S.

Background

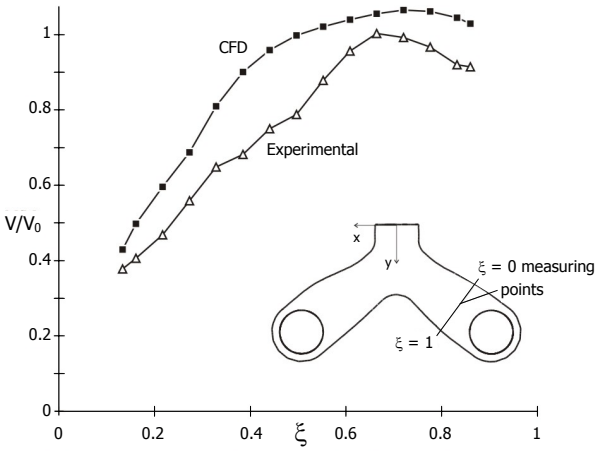
It is important for the efficiency and control of a twin pump that both pumps have good influx conditions. A flow rotating in the opposite direction of the pump and with an adequate speed of rotation is the optimum flow condition. Both pumps rotate counter-clockwise and the initial inlet manifold creates a swirling flow clockwise in the right duct but counter-clockwise in the left duct. This means that the operational characteristics and the efficiency of the two pumps will be different, which is disadvantageous when the twin pump is part of a larger hydraulic system. The main issue of the investigation is, therefore, to reduce the swirl in the left duct of the inlet manifold through design of a non-symmetrical inlet section. The optimisation was based on numerical calculations of the flow, and have been validated by LDA measurements carried out by Grundfos A/S on the initial design.

Optimisation of the Flow

The flow was optimised by modification of the geometry of the inlet manifold taking into consideration the geometrical constraints. The flow in the initial design showed that a jet was generated by pressure gradients near the split, resulting in a swirling flow in the left and right duct of the manifold.

During direct and intensive cooperation with Grundfos A/S a series of alternative designs were calculated. This procedure ensured Grundfos A/S a more intensive developing process, giving a superior manifold to implement in the complete series of twin pumps.

The numerical calculation and the experiments showed the same overall structure of the flow, and the experiments were used to tune the numerical model.



Measured and calculated velocity distribution in the left duct. Printed by courtesy of Grundfos A/S

Results

The shape of the manifold ducts, the angle between them and the cross-sectional area were varied to control the pressure gradients. The quality of the geometry changes was measured by the angular momentum in the left duct. A total of four different designs were investigated and the final design showed a 40% decrease in angular momentum in the left duct compared to the initial design. Measurements carried out on twin pumps have shown that the new inlet manifold design has balanced the efficiency of the left and right pump. The new concept has been utilised in a line of 20 different twin pumps and has made the Grundfos twin pump the most attractive on the market.

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