



Case study

Design and Optimisation of Process Plant Systems using CFD Methods

DRIVING TOWARDS IMPROVED EFFICIENCY

Our customer was installing their Ceecon, condensing economiser to a steam plant in order to improve plant efficiency. We were commissioned to analyse and adjust the header connecting four boilers to the economising unit. This had to be achieved for any combination of boiler operation.

Four parallel dual-header boilers fed flue gas to the Ceecon's heat exchanger. As the plant operation varied, so did the number and selection of running boilers.

The chosen approach was to minimise the pressure loss in the header and to improve the flow distribution and mixing into the economiser heat exchangers so as to maximise their efficiency.

EXPERIENCE LEADS TO QUICK BENEFITS

We have a wealth of relevant experience, designing and analysing process plant systems for Nuclear, Petro-Chem and Oil and Gas Industries, and this allowed us to immediately improve the baseline header design without the need for analysis.

Furthermore, understanding the process plant as a whole enabled us to effectively manage the varied concerns of the economiser manufacturer, plant commissioners and site owners, (e.g. design constraints/limits, manufacturability, cost, availability etc).

MULTIPLE ANALYSIS METHODS

We had available to us a choice of analysis methods and technologies. The most appropriate technology for the task was a combination of 1D flow analysis and CFD. 1D analysis offered adequate accuracy to predict the pressure loss for various header designs, from which the baseline header shape was adjusted. CFD was then used to fully optimise the design further, specifically looking at the flow distribution entering the heat exchangers.

ADVANCED OPTIMUM DESIGN

Once the baseline design had been developed, CFD was used to evaluate the flow profiles at various operating conditions. Target distributions were set by the client for flow entering the first heat exchanger and a series of vanes were designed with this in mind. The vanes' designs were optimised for position, size, attitude and most importantly number. The flow in the header was manipulated to give the desired distribution at the inlet of the heat exchangers. CFD was also able to give the client important design information such as aerodynamic loadings of the vanes and ideal curvature.

ADDITIONAL BENEFITS

During installation of the header, we were also able to interrogate the CFD models further in order to identify ideal positions for instrumentation such as pressure sensors.

At the end of the project, the customer had a design that performed better, that could be effectively monitored in action, and that was supported by a wealth of data on structural loadings and flow distribution.

Client

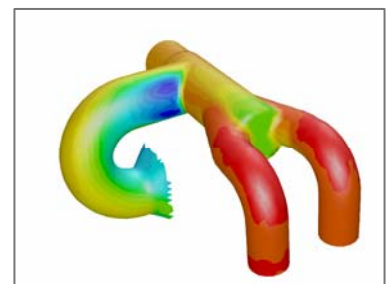
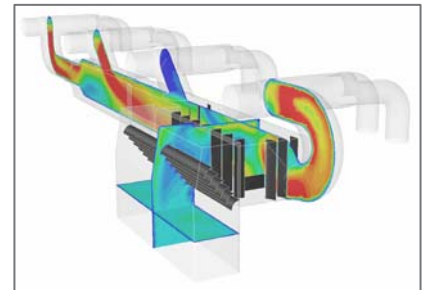
Emvertec Ltd.

Business need

Improving the efficiency of a header unit

Why Frazer-Nash?

Frazer-Nash has a strong expertise in fluid dynamics using state-of-the-art CFD analysis.



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