Flownex®: Optimising Oil Flow in Telescopic Cylinders

Edbro is a market leader in the design and manufacture of hydraulic cylinders for tipper applications in trucks and trailers. Cutting-edge innovation lies at the heart of their continued success, and this drives their requirement for the most technologically-advanced analysis and design solutions. Edbro asked Wilde's help to optimise the internal oil flow in their telescopic cylinders. Wilde achieved highly successful results on this multi-physics project using both Flownex and ANSYS Fluent software, a fast, reliable and accurate total system and subsystem solution to thermal-fluid simulation.

Company

Edbro is a member of Jost World, with a history that dates back to 1916, when the company's founder, Maurice Edwards, developed the first-ever hoist powered by a truck engine. Since then, Edbro products have remained at the forefront of the tipping market, increasing payloads, reducing tipping times and providing 'fit and forget' solutions.

With an extensive manufacturing plant in Bolton in the UK, and distribution warehouses in Europe and the Middle East, Edbro manufacture all of their products within the British Isles. However, with subsidiary offices and further partnerships throughout the world, the Edbro network stretches across Europe to Africa, Asia and Australasia.

Challenge

Telescopic cylinders for tipping applications use hydraulic oil delivered under pressure from a truck mounted pump. During lifting and lowering, the internal oil flow is complex and variable, as tube movement opens and closes orifices. Understanding the effect of those flows is critical to the assessment and design of the internal features of the cylinder.

Edbro therefore asked Wilde to evaluate flow, pressure and forces induced at locations in the cylinder whilst simulating various axial positions of the stages and their relative motion. This information was used to optimise the internal orifices to ensure minimum pressure drops.

The initial results were confirmed by lab testing and proved to be very accurate. This gave confidence that subsequent simulations would be equally valid.
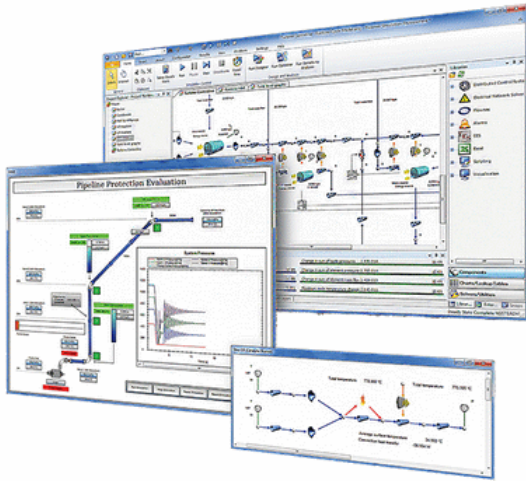

Solution

Wilde used a combination of network analysis (**Flownex**) and CFD modelling (**ANSYS Fluent**) to understand the fluid flow within the actuator system and to highlight possible fluid dynamic mechanisms. **Flownex** (1D CFD solver) was used to estimate pressure and flow rates and further CFD simulation provided calculations of the radial and axial components of forces acting.

Four optimised design configurations were examined and the most effective one recommended.

> **"** I was very impressed with the knowledge and tools available to us through Wilde and the **accuracy of their first model predictions** compared to my test results. This has already become a **seminal piece of work** that will underpin a significant future product development.

Business Benefits

This project enabled Edbro to gain a detailed insight into a poorly understood area of cylinder design thereby identifying potential issues before they became problematic. Edbro were then able to change design very successfully by using the proposals generated by Wilde through an optimisation process.

About Flownex

Flownex Simulation Environment (SE) is a fast, reliable and accurate total system and subsystem solution to thermal-fluid simulation, enabling you to rapidly predict, design and optimise for flow rates, pressures, temperatures and heat transfer rates.

With the ability to model any combination of liquid, gas, two phase, slurry and mixture flows in both steady state and dynamic conditions, coupled with a comprehensive library of components including pumps, turbines, valves, compressors and heat-exchangers, Flownex provides an ideal systems-based simulation tool for virtually all fluids-based processes.