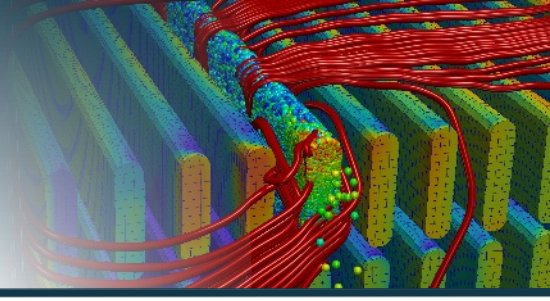
CFD -Tools for Filtration Applications



Specialised simulation tools for filtration applications

Simulation methods such as computational fluid dynamics (CFD) are increasingly becoming an established tool for optimizing plant processes and thus making them more efficient and safer.
For filtration applications, this leads to

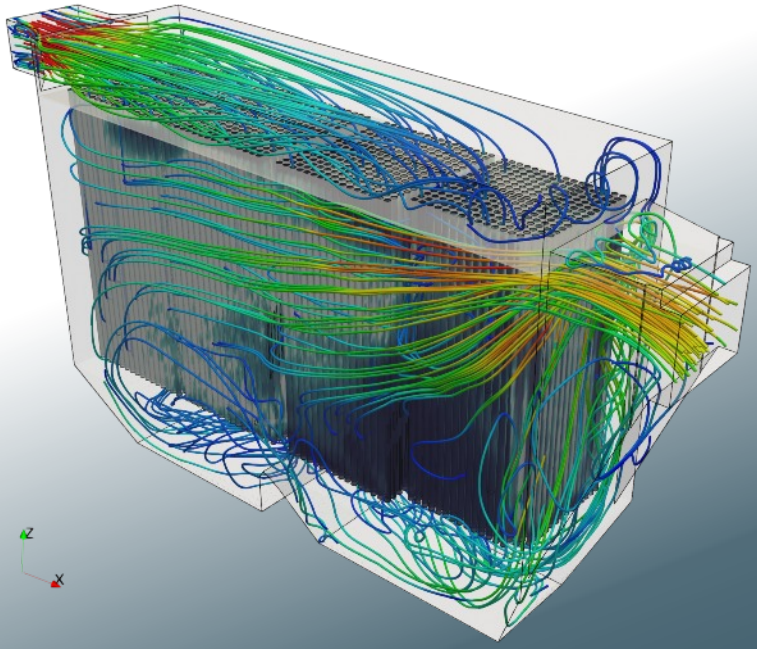
- energetic process optimisation due to a lower pressure loss
- longer service lives with reduced downtime of the plant
- lower operating costs of the plants and
- better utilisation of the filter material.

Modelling approach

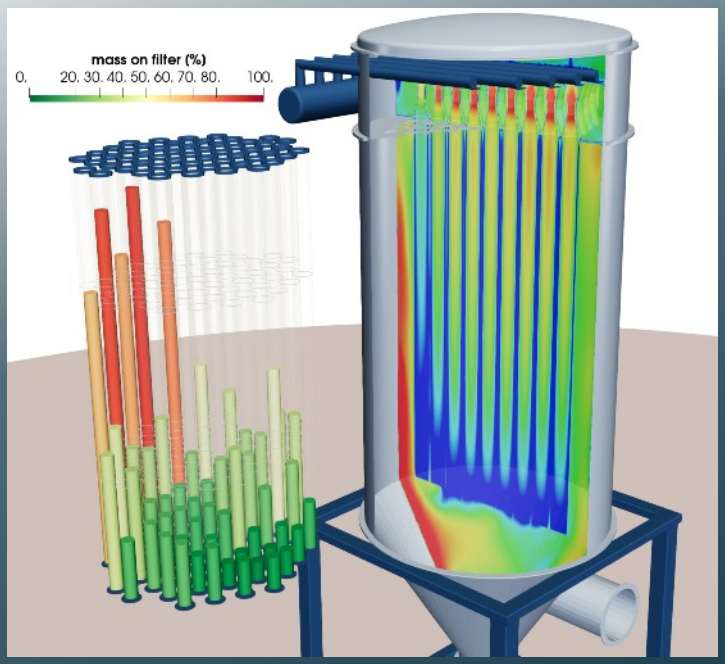
The filtration tool developed by DHCAE Tools calculates both the continuous flow and the transport of the discrete particles in a so called Euler-Lagrangian approch. In an iterative process, particles are added to the initial fluid flow and their deposition location is determined. The particles that deposit on the filters locally increase the resistance. Subsequently, the fluid flow is recalculated and updated for the next particle transport resulting in relocated deposition locations. The modelling approach considers the individual particle sizes and particle interactions, such as deposits or impacts on walls and sedimentation.

Targets and results

This special CFD tool, which can take into account the entire particle loading process up to cleaning, is used to optimize the arrangement of filter elements as well incoming flow to the filter elements. Highly loaded filter elements are thus already identified in the planning phase of the plant and potential measures are checked for their effectiveness on the computer.



Particle deposition in a dust filter system with more than 1000 filter elements



Velocity distribution in the filter plant and deposition of the particle mass on the filters

Tool environment

The filtration tool is based on the renowned open-source CFD toolbox OpenFOAM. This guarantees the use of accurate and established simulation methods at low cost and fast simulation performance due to excellent parallelisation methods.

A filtration case can be created particularly easily and user-friendly in the graphical user interface of DHCAE Tools. Solution settings and boundary conditions are defined in relation to the imported CAD geometry. A special meshing is performed here, which leads to stable and accurate results with low computation time, especially for applications with many filter elements.

The simulation process is also monitored by a graphical interface, in which important information about the simulation process, such as the pressure increase with increasing particle loading, is already displayed.

Evaluation procedures and damage models are integrated so that filters can be analysed and optimised easily and reliably.

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