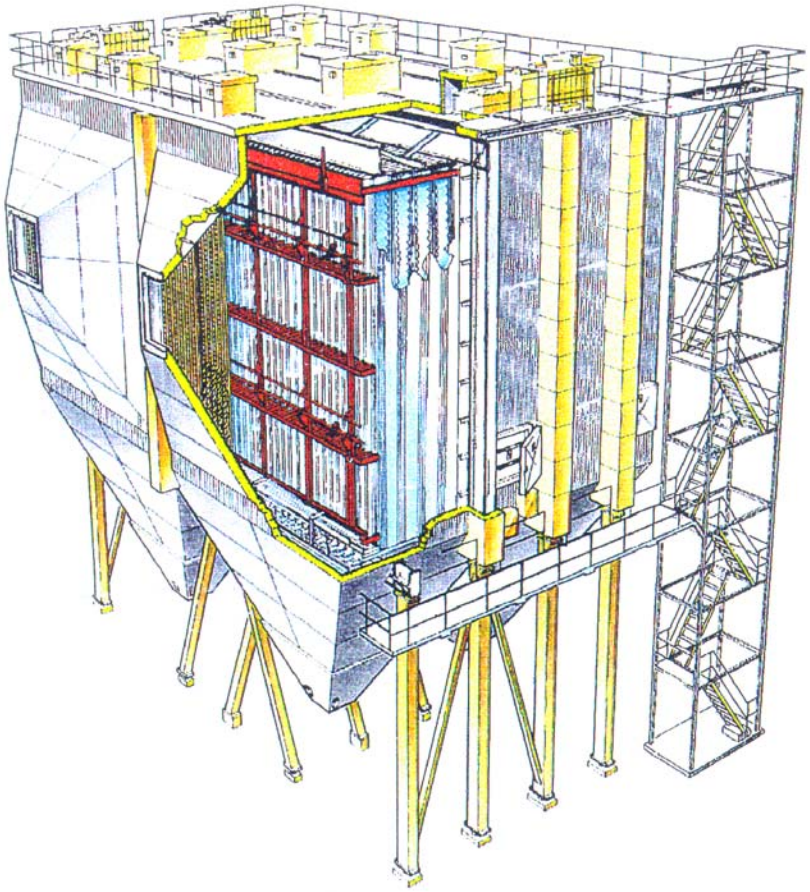
Development of a generic design tool

Flow and Energy Optimization of Electrostatic Precipitators



FORCE Technology and FLS miljø a/s have carried out a project with the aim of developing a generic tool for the design of flow-conditioning devices applied at inlets of electrostatic precipitators.

The main objective of the project was to reduce the energy consumption and to obtain a better industrial process by developing and applying modern flow-calculation methods for design of new and reconstruction of existing flue-gas cleaning plants.

Through application of the method, optimization of the gas distribution in electrostatic precipitators has been achieved resulting in:

- reduced energy consumption
- reduced emission levels
- higher efficiency.

The developed model is based on Computational Fluid Dynamics (CFD) with which the threedimensional flow in an electrostatic precipitator can be calculated and the effect of flow optimization devices such as screens can be predicted.

The implemented model is designed especially for FLS miljø's screens; however, the basic model is generic and can be applied with different input data for calculation of the flow field in other designs and applications.

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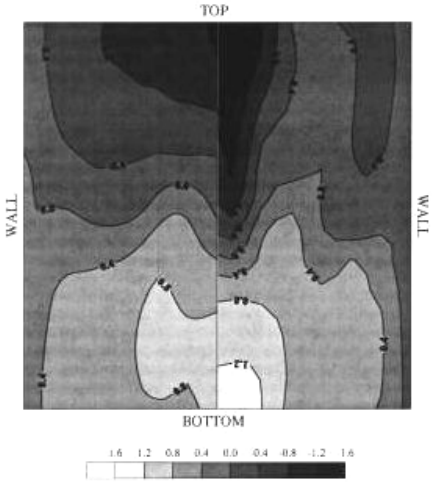
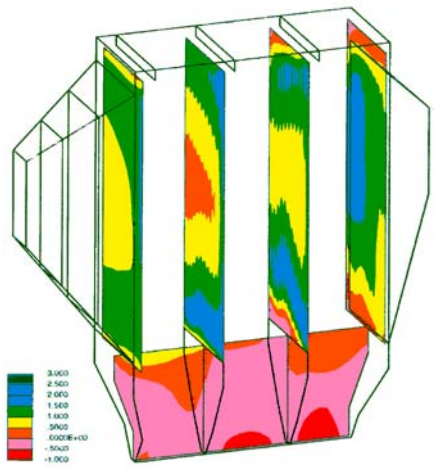
Accurate modelling of the entire screen geometry with CFD would demand more computational effort than that of computers of today. Instead, the effect of screens on the flow was modelled through implementation of the resulting forces acting on the flow due to the screens, reducing the computational effort significantly.

A series of physical model-scale tests with flow through screen elements were carried out, partly to generate input data for the model, partly to verify the model. These tests yielded detailed information about the effect of the specific screens applied by FLS miljø.

On the basis of the model tests it was possible to verify equivalent numerical calculations of flow through screen elements, so that input data could be established by numerical means. A detailed database containing the forces acting on the flow due to the screens was set up and applied as input data in the model. The model was applied for prediction of the gas distribution in FLS miljø's electrostatic precipitators, and comparisons to experimental scale model data as well as full-scale measurements were carried out. Satisfactory results between experimental data and the model predictions were found. The project has shown, that it is possible and advantageous to apply numerical calculations for dimensioning of flow-conditioning devices. The developed model is flexible and allows a fast evaluation of different screen configurations leading to easier design and optimization.



Velocity distribution. Comparison between computed results (left) and experimental data (right).



Axial velocity distribution in different planes in an electrostatic preciptator.

Industrial Fluid Dynamics

FORCE Technology has long experience within flow optimization of industrial equipment and apparatus. Examples are furnaces, flue gas cleaning equipment, pumps, compressors, mixers, heat exchangers, separators and valves. Our consultancy services are based on access to state-of-the-art soft- and hardware facilities together with sophisticated flow-measuring equipment and modern laboratory facilities. This enables FORCE Technology to offer you a unique combination of both physical experiments and numerical investigations.

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