FACTS

SINTEF Materials and Chemistry

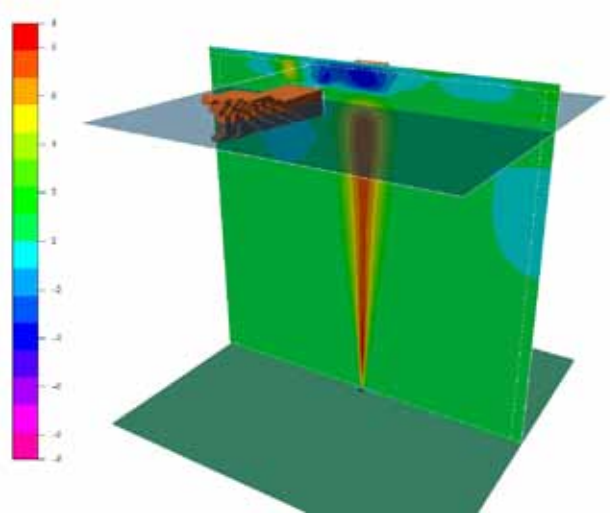
Computational Fluid Dynamics

August 2010

- Applied to Reactor Technology and Process

Our Motivation

Computational Fluid Dynamics (CFD) offers a quick and cost effective means to explore the efficiency of various designs and solutions for process equipment and reactors, without the need for costly pilot scale experiments. Furthermore, when good models can be developed for the various phenomena found in the system, CFD can be used to gain valuable new insight into the basic properties of the overall process. It is our mission to aid the process industry in this work, and to make the power of CFD, combined with our extensive knowledge in reactor modeling, gas purification, separation, crystallization, membrane technology and development of pilot scale facilities, available to the industry.



Added Value

The main body of engineering experience within the process industry is often summarized as non-dimensional correlations based on experimental observations. Great care is exercised when developing correlations to identify the key parameters controlling the process. However, a major drawback with a correlation is that its range of validity may be restricted. The process at hand can differ in some key aspects from those assumed in the correlation, thus reducing its value. In many cases CFD can improve on this situation, by removing the assumptions made about the flow field, and solving the conservation equations for mass, momentum and energy for the actual geometry. This approach reveals the details of flow, and armed with this knowledge, process developers may quickly identify and remove obstacles in designs, gaining new valuable insight into the process.

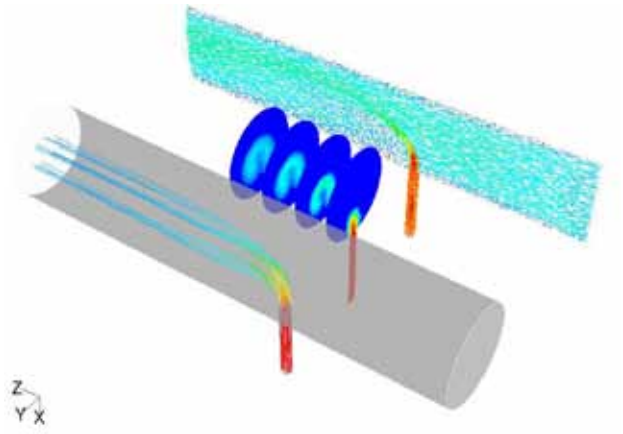
We believe we can help our customers decide when to use CFD, traditional modeling or pilot scale experiments based on our wide range of experience in these areas.

Mixing and Blending

The design target for mixing and blending equipment is a combination of minimizing mixing time and costs on the one hand and maximizing product quality and consistency on the other. Typical processes include dispersing solids into a liquid, dissolving a gas in a liquid, emulsification of immiscible liquids or disintegration of suspended solids and agglomerates. These tasks can be achieved either in-line or in batch.

Separation

Separation processes span a wide range of applications from oil-water-gas-solid separators offshore, dredging of contaminated river and sea beds, to separation of particles from flue gas, and retention of fines from process fluids, such as in cyclones. CFD combined with development of physical models for these phenomena can improve designs, yielding higher product quality and more environmentally friendly processes.



Reactor Flows

A number of reactor flows can benefit substantially from CFD analysis. In traditional reactor modeling certain assumptions are imposed on the flow field in the reactor. These assumptions can be relaxed substantially using CFD, revealing stagnant regions with poor mass and/or heat transfer, or recirculation zones where solids might accumulate and start fouling on walls and internals. Examples are fluidized beds, bubble columns, slurry bubble columns and stirred tanks.

Your Partner

In Norway, SINTEF Materials and Chemistry has a wide range of projects within CFD. Recently we concluded a 5 -year co-operation with Statoil focused on CFD applied to multiphase flow in chemical reactors, process equipment and multiphase flows offshore.

Currently we are heading the model and tool development work in a 9 year program aimed at developing a new generation of multiphase pipeflow simulation tools for the oil and gas industry.

SINTEF Materials and Chemistry has a close co-operation with other SINTEF Institutes and our sister departments at NTNU (Norwegian University of Science and Technology). The CARPET program is a result of this co-operation and will run from 2001 through 2004. Together with our NTNU advisors our team of approximately 20 SINTEF researchers working with CFD and pilot scale flow studies form one a leading research group within the field. Our main customers are petrochemical, pharmaceutical and metallurgical industry.

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