

SCHEME, PROCESS ENGINEERING RESEARCH MODELLING.

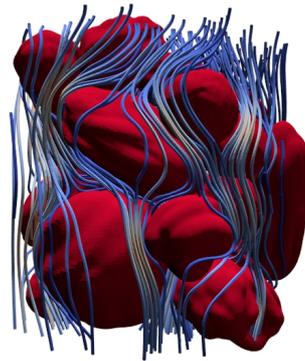
Studying the method of atmospheric dispersal of a pollutant. Sizing and optimising the methanisation, bio-drying and composting process. Simulating a bioreactor's aerualics. Defining the effective parameters of a porous media from pictures obtained by X-ray computed tomography.

These are some typical applications that SCHEME is able to model and simulate.

Multi-scale transport in porous media

An important field of SCHEME's activity is modelling reactive transport in a porous medium. In other words, the simulation of fluid flows of various origins in porous media and the chemical and/or biological transformations deriving from it. These transformations are caused by the interactions between the components of the different medium stages or the components of the fluids considered. The mathematical models resulting from the study of these various strongly coupled phenomena are solved using complex simulators called «Multi-physical Computational Fluid Dynamics». These tools enable us to achieve simulations and conceptualisations relat-

ing to the environment and process engineering research such as: bioreactors (e.g. industrial composting, methanisation, bio-drying), biofiltration, fixed-bed gasification, the transfer of pollutants in the groundwater, etc. To be able to solve these issues SCHEME uses the OpenFOAM solver (Open Field Operation And Manipulation). It is a multi-physical and open source toolbox mainly aimed at solving fluid mechanic equations, using the finite volume method. This solver is encoded in C++ (object-oriented programming) and has parallelism tools that allow it to take into account complex 3D geometry.



3D small scale simulation of the current lines of a fluid flow in a porous medium

OpenFOAM® gathers more than 200 programs engaging in the different steps of the digital processing of a given issue:

Preprocessor :

- mesher (blockMesh, snappyHexMesh...)
- meshing converter (Ansys, Salomé, ideas, CFX, Star-CD, Gambit, Gmsh...)

Solver :

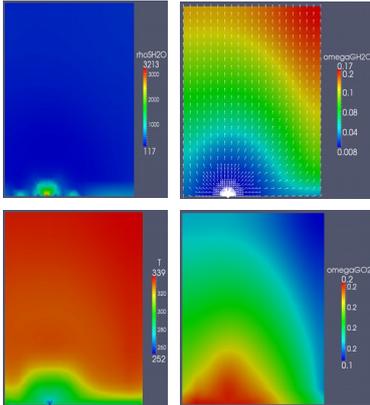
- incompressible / compressible flow
- multiphase flow
- combustion, electromagnetics, structure
- heat transfer
- many turbulence approaches (DNS, RANS, LES)

Post processing :

- visualisation with ParaView
- export towards other post-processing platforms (Fluent, Fieldview, EnSight...)
- 1D or 2D sampling

Results

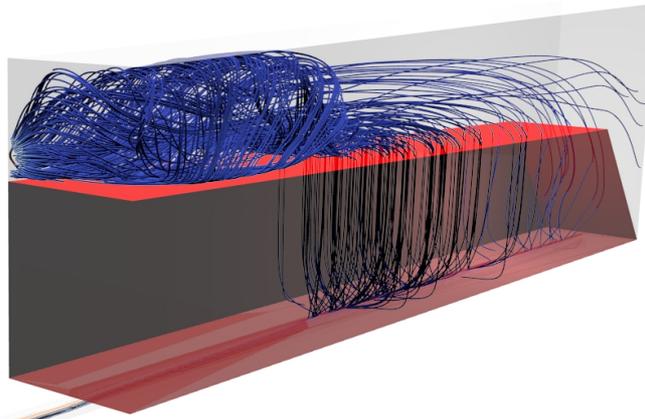
2D and 3D reactive transport models:



- Composting
- Methanisation
- Bio-drying

Our added value is created by the development of new solvers and digital solutions as well as the fulfilment of a high level expertise assessment by means of the simulations we carry out. This expert assessment can be on the aeraulics or hydraulics of a part of the whole of a process or on its dimensioning and optimisation.

We have developed a model on composting compartments that allows us to size them according to their structure and equipment. This model also enables us to test the decomposition phenomena of various types of waste and to assess new processes in this bioreactor.



3D simulation of the aeraulics of a composting compartment (display of the current lines)

References

SCHEME was appointed by CYLERGIE, a research branch of GDF SUEZ, to develop a model on industrial composting in compartments and to participate in the formulation of a prediction model on fuel quality.

Small scale simulation of the dispersal of a pollutant through a model porous media

