# THERMAL AND PRESSURE CHARACTERIZATION OF LOUVER/MESH LIKE HEAT EXCHANGER STRUCTURES FOR POROUS MEDIA SURROGATE MATERIAL IN CFD SIMULATIONS

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**KEYWORDS**

CFD, Multi-scale, Heat Exchanger, engineering-oriented simulation, Frontloading

## ABSTRACT

Heat exchangers are used in a variety of designs in all industries. For the most common types reliable dimensioning programs exist that have been developed by commercial vendors or from the equipment manufacturers themselves. With these design programs the design points can be calculated accurately. The complementary use of 3D thermal and flow simulations (CFD) arise among other things for the following advantages:

- Analysis of distribution problems of the flow
  - uneven impingement and therefore loss of performance
  - thermal problems caused by uneven temperature distribution
  - avoiding dead zones
  - Dirt accumulation / erosion behavior, local evaporation / condensation / icing
- Evaluation of operating points that differ greatly from the design point
- Transient considerations
- Calculations with boundary conditions that lie (far) beyond the empirical specifications

- Simulating of applications, for which no empirical dimensioning programs exist (special designs)
- Evaluation of pressure and temperature for further use in stress analysis (FEA)
- Detailed analyzes of specific areas (e.g. flow distributors)

Modern CFD simulation tools allow an early assessment in the design process of the points mentioned above. Depending on the application area and status of the project, also an adaptation or review of the components at a very late stage can be required. The analysis of the changed operating conditions and possibly identified modifications can be carried out in such a case in the short term. Thus, high expenditures, such as extra costs or time delays can be avoided. Consequently, the components can be optimized with supplementary CFD analysis both, in the design process (frontloading) and at a later stage.

With the CAD embedded 3D thermal and flow simulation software FloEFD, examples for an effective implementation of the simulation are shown. The focus is on an engineering-oriented approach for the implementation of the simulation taking into account the current available physical models, such as the use of porous media as a "surrogate material", the automatic detection and definition of the fluid volume and the automatic meshing. The use of these modern technologies enables an efficient and engineering-oriented simulation. This can be carried out during the development phase and thus ensures a cost- and resource-optimized product development. The individual steps to define the boundary conditions, solving and evaluation (post processing) are presented.