CFD analysis capability for to the design of Innovative Heat Exchangers

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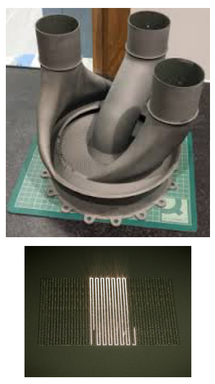
Introduction

The thermal modelling and analysis of complex 3D geometries at micro- and macro levels present significant challenges to the design of novel heat exchangers, produced by metal power-based Additive Manufacturing (AM). The primary aim of the KTP between HiETA Technologies and the University of Exeter is to develop an advanced in-house computational fluid dynamics (CFD) capability that will complement HiETA's activities in the design of highly efficient AM components for thermal management field and heat recovery.

HiETA

HiETA is a product design, development and production company exploiting AM to deliver innovative engineering solutions for aerospace, automotive and defence applications.

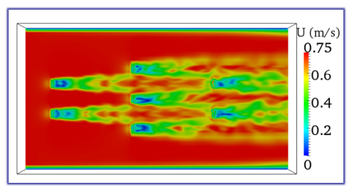


KTP Associate

Engineer in Fluids Mechanic, Elvire Meyers developed an interest for Computational Fluids Dynamic during her studies and previous work experiences.

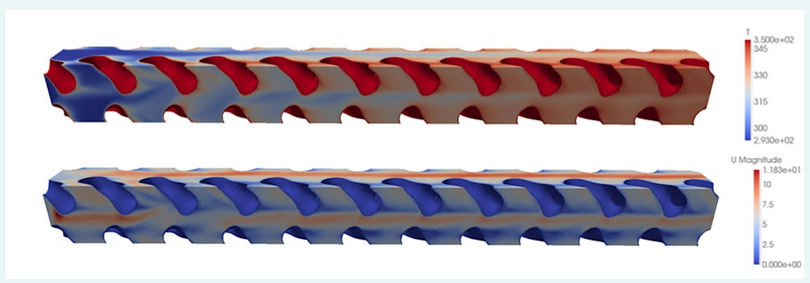
University of Exeter

The University of Exeter is at the forefront of developing advanced CFD techniques with Open Foam in the UK.



The two-year project consists of conducting a multiscale CFD simulation of a complex heat exchanger incorporating lattices structures.

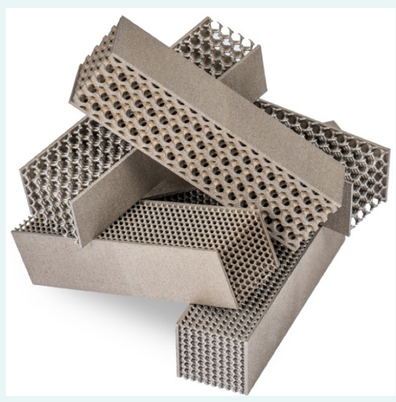
Performance of lattices at a unit cell level



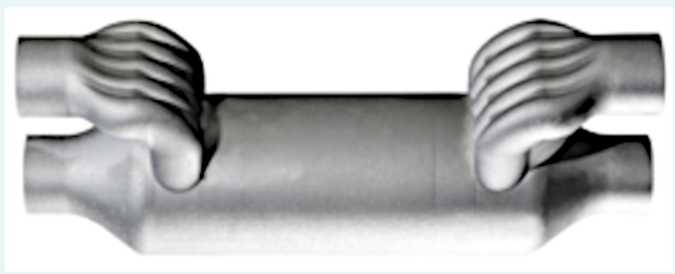
AM enables the incorporation of complex lattice structures in metallic components. There is a great variety of lattice topologies, each having different thermal performance. The aim of this study is to investigate the thermal performance of targeted lattice structures at a unit cell level.

Modeling of the lattice structure as a porous media

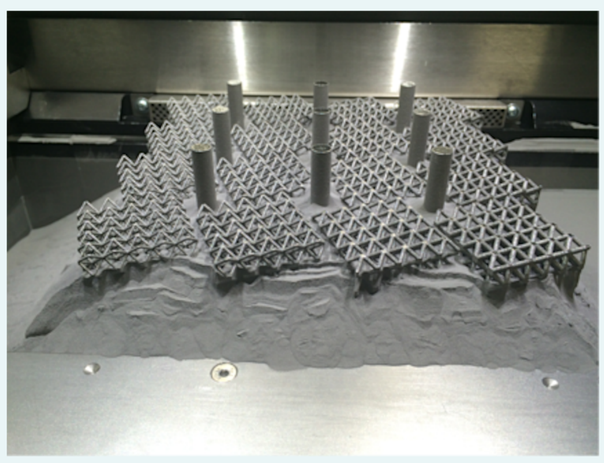
From the thermal performance of the chosen lattice at the unit cell level, it is possible to develop a model for heat transfer and pressure drop. This model can then be implemented to simulate the group of lattices topologies as porous media.



CFD Capability for Heat Exchangers Design



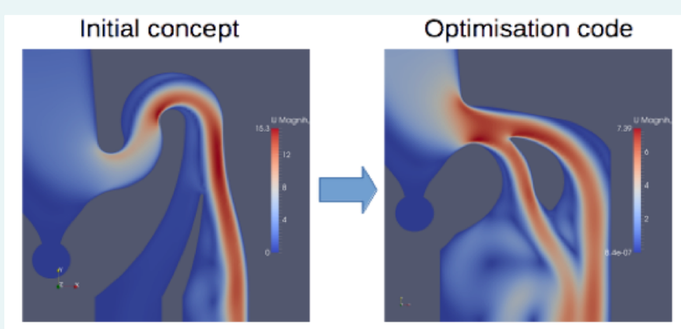
Powder removal



The effective removal of powder from components produced by AM is critical to the performance and technically very challenging. Advanced CFD will be used to model powder behaviour and extraction.

Manifold optimization

AM can produce easily any design removing any constraints on the end design. This design freedom introduces the ability to optimize the geometry of the part for an optimum flow path; in our study of the manifolds.



HiETA

The KTP will enable HiETA to build a portfolio of innovative, lightweight, and highly efficient components for thermal management and heat recovery. The developed methodology will be integrated to optimise the design of AM components through the application of advanced CFD techniques.

KTP Associate

This KTP associate is developing knowledge in several domains such as additive manufacturing, heat exchanger design and CFD through the project. Additionally, the KTP associate will develop an expertise in the open source CFD software OpenFoam for various solvers and simulation cases.

University of Exeter

This project gives the opportunity for the University of Exeter to collaborate with industry and use their knowledge and expertise to solve complex problems, including multi-scale CFD simulation and shape and flow path optimisation. The KTP helps the university to build a research expertise relevant to industry and increase its visibility to companies.

UNIVERSITY OF EXETER

College of Engineering, Mathematics and Physical Sciences

HiETA technologies

Innovate UK