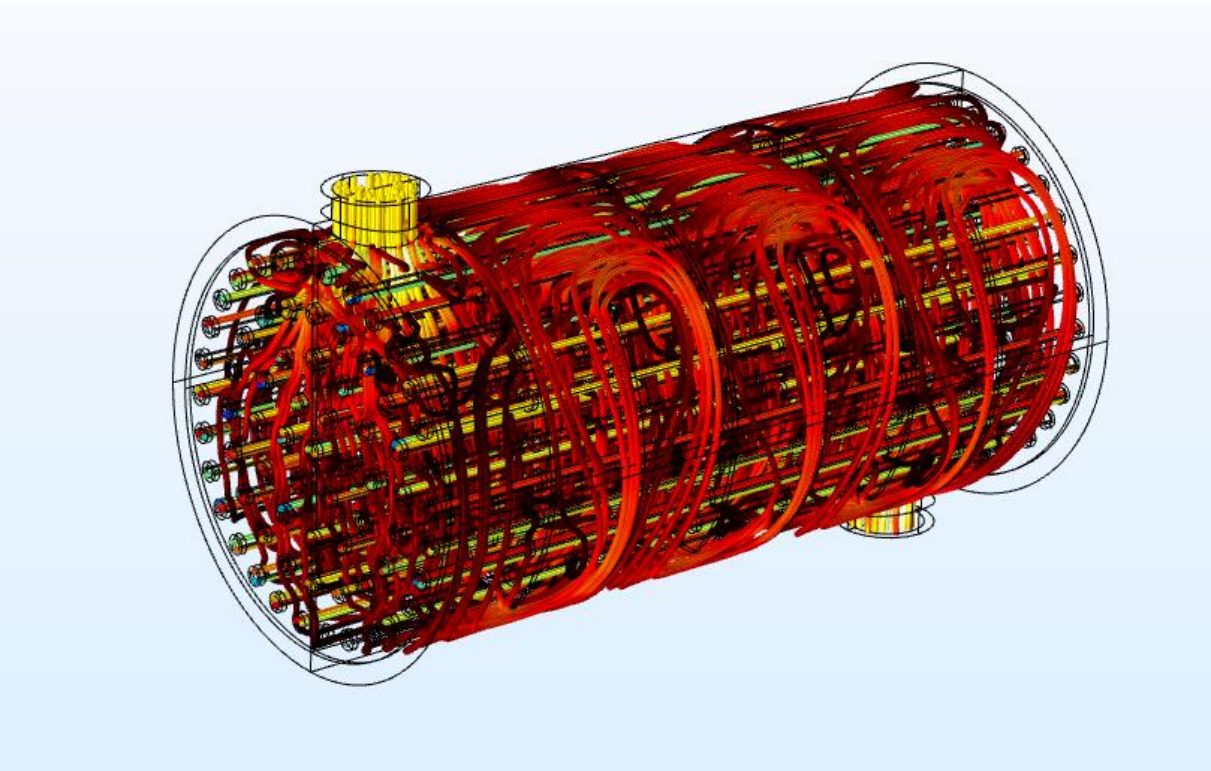

3D-Printing - Technology to design evolution

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Radiators for keeping warm in winter, AC for those hot summer days, that smartphone that keeps getting too hot. All of these and many more applications need heat exchangers. The most efficient heat exchanger known is the human lung. With 3D printing the complexity of a lung might be possible to copy.

The technology to increase or decrease temperature is seen all around us and there are numerous ways to accomplish this. Even if conventional heat exchangers can be made quite efficient, they are still nowhere near as efficient as those designed through millennia of evolution. This work was centred around designing and printing a heat exchanger that would not be possible to manufacture with conventional techniques.

The human lung is around 20 times as efficient as common heat exchangers. Through the rapidly developing technology of 3D-printing there is a possibility to get closer to the complex designs found in nature. This would not only mean a better heat exchange but also be very beneficial for energy use, which with climate change is of huge importance.

The different forms of heat transfer come in three. Radiation is the heat the sun produces to warm our planet. Conduction is the heat you feel when you touch a hot pan that has stood on the stove. Convection is the heat transfer for cooling your hand in running water after it was burned on the pot. All these types of heat transfer happen in a heat exchanger, but the radiation is very small in the big picture. As there are many things happening at once, the ability to give numbers of what is happening is difficult. To help engineers there are sophisticated software which can help in doing Computational

Fluid Dynamics (CFD) calculations. This software is used to simulate the flow, temperature and pressure in the heat exchanger of choice.

In this thesis it is shown that the design of an average heat exchanger may be changed through the help of 3D-printing, creating a more efficient heat exchanger. The important things to think about when creating with 3D is that as little as possible post processing should be needed.

3D printing technology uses a metal or plastic powder in a powder bed that with a 3D model as drawing uses a high focused laser to melt the powder and this way builds the part. The residual powder needs to be removed after printing with post processing. Through clever design this post processing can be reduced to a minimum. It is believed that this knowledge can help push research forward in the field of heat exchangers, creating the heat exchangers of tomorrow. It is shown that previously impossible designs quite easily can be done with 3D printing.

The technology of 3D printing has huge potential of creating a smarter and better heat exchanger. If the heat exchanger can be made smaller but with the same output this could have big impacts on cost and more importantly it is more sustainable. Less energy needed to have the same effects means less emissions. It could be used in everything from industry and refineries to home applications such as home brewers wanting a better way to cool their latest batch of beer.

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