UK FLUIDS NETWORK	Numerical Simulation of Nanofluid Heat Transfer in Microchannel Heat Sinks (Short Research Visit Report) **Dr. Hongwei Wu**, School of Engineering and Technology, University of Hertfordshire		
Visiting Host:	Prof. Xudong Zhao, School of Engineering and Computer Science, University of Hull		
Start Date:	27th May, 2018	**Completion Date:**	1st June, 2018
Report to:	**Dr. Nick Daish**, Department of Engineering, University of Cambridge		

A successful short research visit from University of Hertfordshire to University of Hull took place from 27th May to 1st June, 2018. Future research collaborations have been established through this visit.

Microchannel heat sinks (MCHS) were introduced in 1981 by Tuckerman and Pease due to their heat transfer efficiency, cost-effectiveness and reliability. Nowadays, microchannels are used in microelectronic cooling, industrial heat exchangers, automotive applications, cooling of gas turbine blades, power and process industries, HVAC systems, bioengineering, infrared detectors and laser mirrors, renewable energy, microsensors, etc.

Nanofluids are expected to exhibit high thermal conductivities compared with conventional heat transfer fluids, and they represent the best prospect for enhanced heat transfer. As a result, nanofluids have attracted worldwide attention by thermal scientists and engineers, with explosive growth of experimental studies on nanofluids' thermal and hydrodynamic behaviour in the last two decades. Today, nanofluids applications are successfully employed in a wide range of industries, including: heating (drying process, tempering process), renewable energy (solar collectors, solar water heater, solar panel cooling, fuel cells), cooling technology (Heat exchangers – car radiators, industrial exchangers; Boiling – Nuclear reactors, acoustic cavitation; Electronic chips – heat sink, heat pipes, impingement jets; Spray cooling; Turbine blades; Lubrication – Engines; Medicine – drug delivery, cancer therapy; Combustion).

During the visit, we discussed the potential application of using nanofluids in microchannels for cooling technologies and we also discussed the use of machine learning/AI to replace the modelling for predicting the thermal behaviour in a more accurate manner. We also intend to investigate further the flow and heat transfer in microchannels under rotating conditions, which can potentially be applied for rotating turbine blades. Some CFD simulations will be carried out for inclusion in a potential joint publication.

Acknowledgements: We would like to acknowledge the financial support from UK Fluids Network.

With Prof. Xudong Zhao's research group.

BIPV/T system at University of Hull.

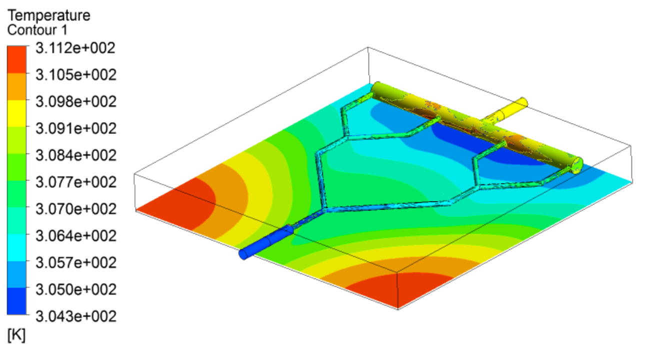

Fig. 1. Temperature contour.

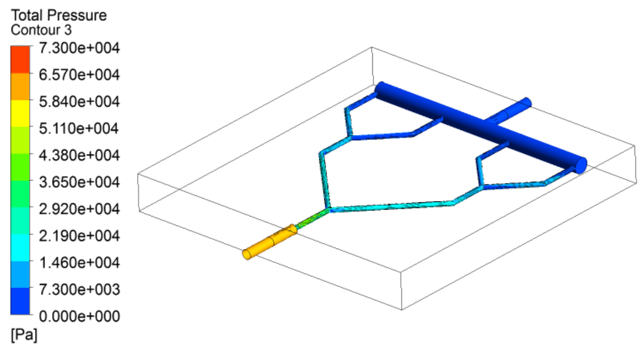

Fig. 2. Pressure Contour.

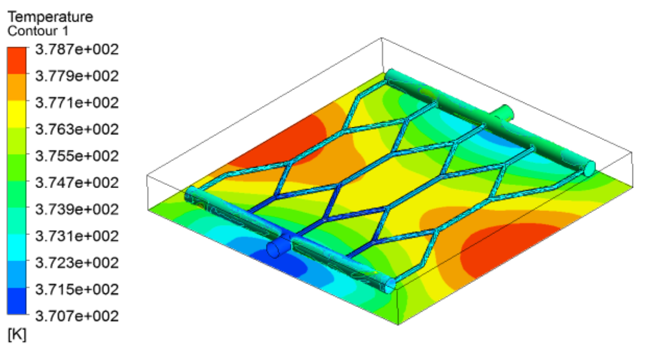

Fig. 3. Temperature contour.

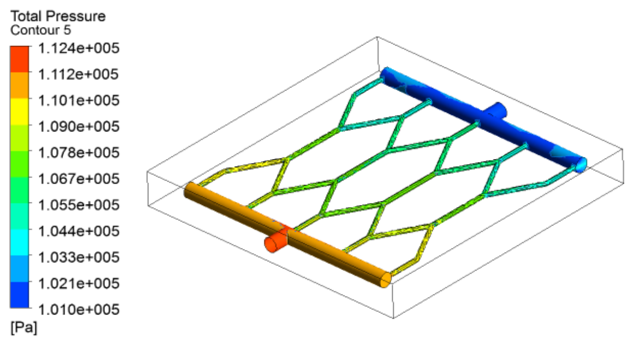

Fig. 4. Pressure Contour.

Figure 1 & 2 shows the temperature and pressure distribution when the working fluid flow through a Y-microchannel based heat sink with a heat flux of 25000 W/m^2 and flow rate of 1 l/min.

Figure 3 & 4 shows the temperature and pressure distribution when the working fluid flow through an improved design can lead to more stable distribution of temperature on the device which is being cooled using the heat sink.