TransferTech SHERBROOKE

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ENERGY-EFFICIENT SELF REGULATED HEAT SINK

CONTEXT

Data centers are not free of environmental impact: today, they account for around 1.5% of global electricity demand and, up to 40% of this consumption is associated to its cooling systems. To meet the increasing power density of microprocessors and reduce cooling power requirements, data centers are increasingly moving from air to liquid cooling alternatives due to its higher heat capacity, compactness, and higher cooling performance.

Nevertheless, current liquid-cooled devices for advanced microelectronics, mainly based in microchannels cold plate, are not optimized for real operating conditions, where the heat flux distribution changes spatially and over time and current cooling systems cannot provide high-performance levels, leading to temperature non-uniformities and overcooled systems.

The thermal management market was valued at USD 8.99 Billion in 2016 and is estimated to reach USD 14.24 Billion by 2022, at a CAGR of 7.91% during the period 2017 and 2022.

TECHNOLOGY

UniSCool proposes to improve current cooling systems through a patented and highly innovative liquid cooling system, based on a self-adaptive heat sink that includes a series of thermally activated fins capable of efficiently adapting its local heat extraction to variable heat fluxes. In this way, the fins rise with increasing temperature to disturb the fluid and reduce the local thermal resistance, providing high temperature uniformity across the device regardless of heat flow. On the contrary, when the temperature decreases, the fins remain in a flat position to minimize pumping power. These fins are based on shape memory alloys or bimorph structures that deform based on their own temperature, without the need for external sensors or actuators.

ADVANTAGES

The product offered by UniSCool is an intelligent and cost-effective direct-to-chip liquid cooling solution that removes thermal constraints to increase data centre processing capacity (up to 300 W/cm^2 with high chip temperature uniformity) and allows the rapid growth of applications such as 5G, VR or AI with low power consumption (-70% compared to current solutions), high performance and reduced space in a sustainable and environmentally friendly way.

APPLICATIONS

The potential markets for the liquid-cooling device are data centres, microelectronics, power electronics, concentrated photovoltaics, and electric vehicle.

TECHNOLOGY READINESS LEVEL (TRL)

TRL6, seeking for pilot tests for industrial validation of prototypes. Available for exclusive and non-exclusive licensing.

INTELLECTUAL PROPERTY

Patent pending: United-States, Europe and Canada

SEEKING

- Development partner
- Commercial partner
- Licensing
- Seeking investment

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PROOF OF CONCEPT

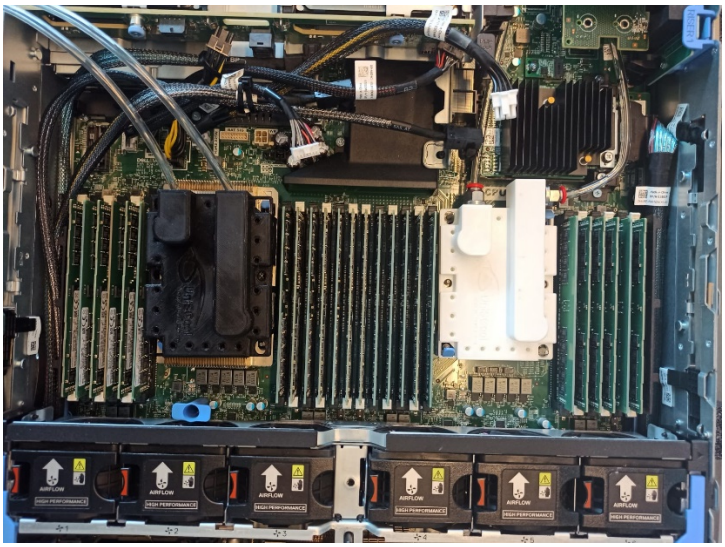

Figure 1: UNISCOOL direct-to-chip liquid cooling inside a server.

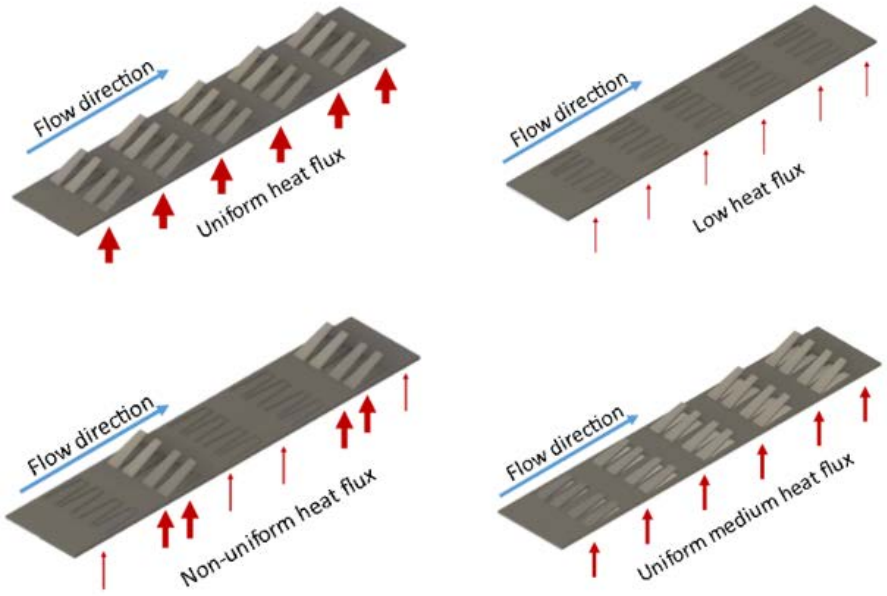

Figure 2: Behaviour of the self-adaptive fins under different heat load scenarios

List of scientific publications

- D. Regany et al., **"Design and test of shape memory alloy fins for self adaptive liquid cooling device**," Appl. Therm. Eng., vol. 206, p. 118010, Apr. 2022. https://www.sciencedirect.com/science/article/pii/S1359431121014307

- M. Vilarrubi et al., "**Numerical evaluation of bimetallic self-adaptive fins acting as flow disturbing elements inside a microchannel**," in InterSociety

Conference on Thermal and Thermomechanical Phenomena in Electronic Systems, ITHERM, 2022, pp. 1–7. https://ieeexplore.ieee.org/document/9899648/

- M. Vilarrubí, G. Morell, J. Rosell, L. G. Fréchette, and J. Barrau, "**Experimental characterization of a self-adaptive shape memory alloy cooling approach to regulate temperature under varying heat loads**," Int. J. Heat Mass Transf., vol. 139, pp. 632–640, 2019. https://www.sciencedirect.com/science/article/pii/S0017931018336251

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