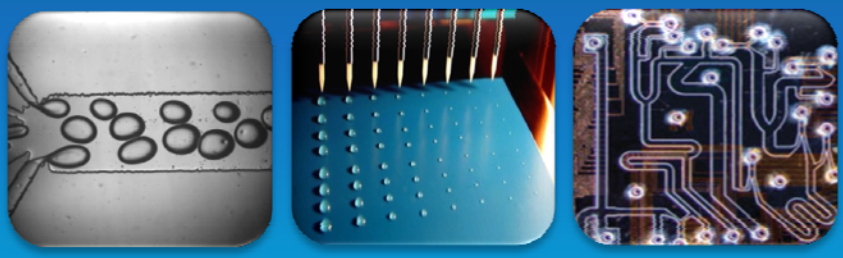
TransAT

High fidelity CMFD solution for microfluidics systems and electronic cooling

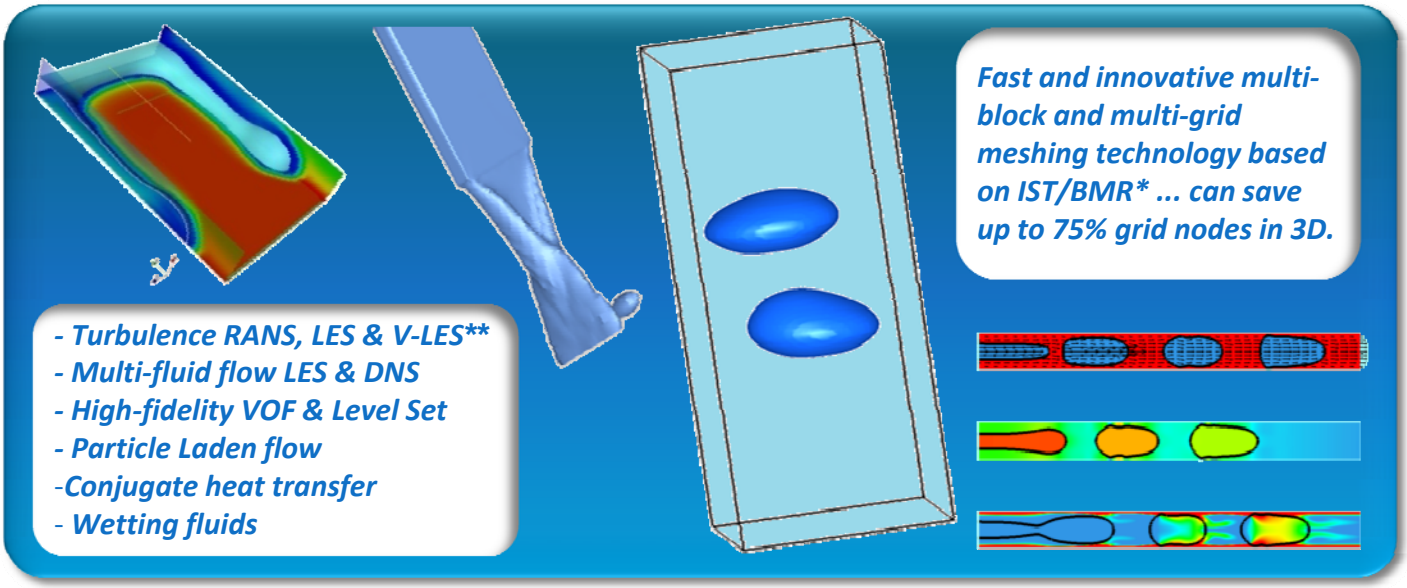
Microfluidics



***ASCOMP GmbH** provides consulting services in the high-tech electronic cooling and the microfluidics sectors, with applications of relevance to the medical diagnostics and drug delivery segments.*

The control of micro-flow systems is central to future technological advances in emerging technologies, like biological reactors, microreactors, biochannel arrays, and labs-on-chip. It is expected that robust, accurate and fast response CMFD will have one of the keys to the stunning success of miniaturized medical devices and diagnostics.

TransAT *allows accurate prediction of microfluidics flows featuring multi-fluid flows (reagents-drops), accounting for relevant physics, including capillary forces, surface forces, Marangoni effects, magneto-electrical effects, and wetting. It also helps solve thermal management in electronic circuits by air fans or via boiling.*

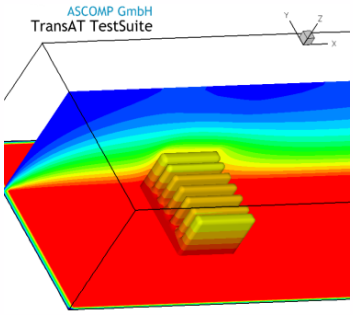


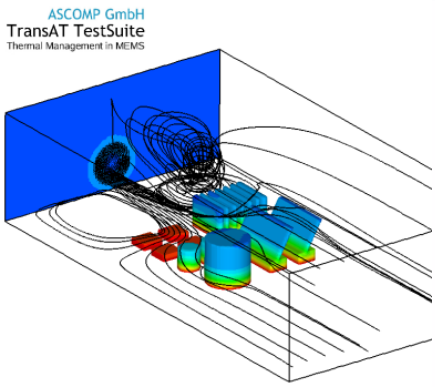
**IST/BMR: Immersed Surface Technology / Block Mesh Refinement*
***LES & V-LES: Large Eddy Simulation & Very Large Eddy Simulation*

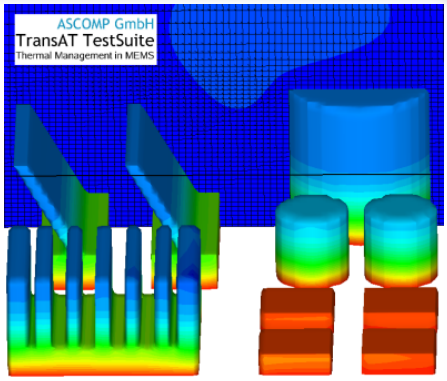
ASCOMP GmbH software package **TransAT** can simulate a wide range of multi-fluid flows. **TransAT** is particularly designed to predicting fluid-fluid multiphase flows (CMFD), featuring large density and viscosity ratios. **TransAT** has unique capabilities to treat wetting phenomenon, phase separation, capillary and Marangoni driven flows, and flows featuring ultra-thin films. As bio-chips may comprise various complex components, the IST/BMR technique alleviates the drawbacks of traditional girding: aspect ratio, cell stretching and skewness.

Trans*AT* provides detailed free-surface flow behaviour in various microfluidics systems, as well as in the electronic cooling and convective heat transfer in microchannels (examples shown below).

PCB electronic cooling:



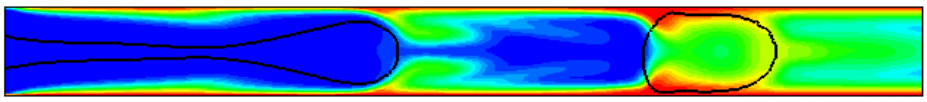




The cooling of electronic boards PCB can be achieved by fan-based convection or two-phase flow. The user is interested to evaluate the cooling capacity of his/her design. CMFD helps provide a faithful picture of what might happen under a specific set-up. Our code **Trans*AT*** has been designed to help re-design engineering operations. Thanks to the IST/BMR module, generating a 3D grid of a complex board is a matter of hours, and treating directly conjugate heat transfer.

Microchannel flows:

Slug formation in a 1mm channel with heat transfer



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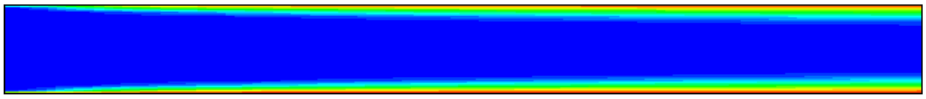
Single phase flow in a channel (water)



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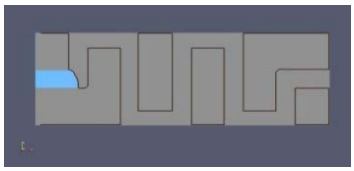
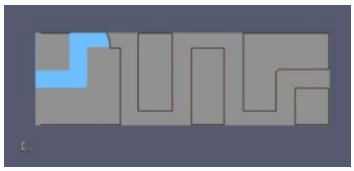
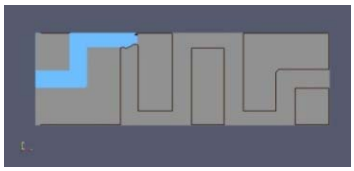
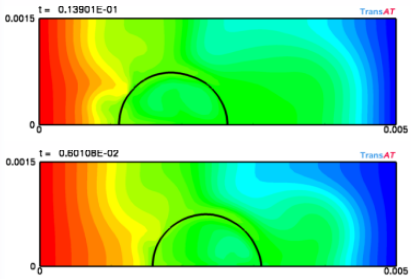


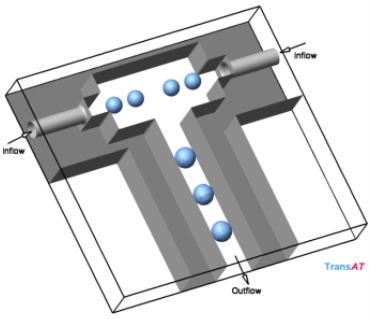


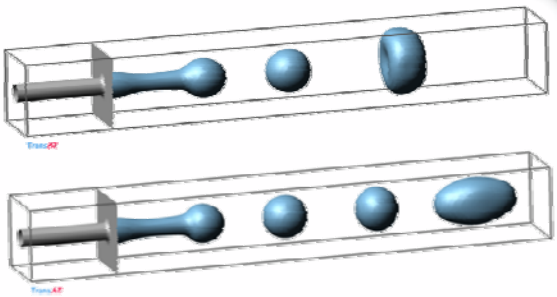


In two-phase microfluidic flows, surface tension forces are dominant relative to other forces, and the Knudsen number is large, reducing the length scale characteristic of the problem to that describing the lighter phase inclusions (e.g. bubble diameter). Liquid flow and heat transfer in microchannels are critical to the design and process control of various Micro-Electro-Mechanical Systems (MEMS).

Flow control in Bio-chips:







The control of the flow (drops carrying reagents) in miniaturized bio-chips is a critical issue in the med-tech sector. The control can be achieved by various ways: wetting by fixing an ultra thin film (right example), by Marangoni forces or imposing a temperature gradient (left example), or via imposing an external magneto-electrical field to move the droplets The cases above illustrate the predictive capacity of TransAT in treating these subjects.

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