

University of Stuttgart Institute of Smart Sensors



Research Thesis

Design of a topology-optimized water-cooled heatsink in COMSOL Multiphysics

Modern integrated circuits (ICs) combine more and more powerful functionality on a single chip. This leads to large power densities of up to 1 W/mm² that are difficult to cool with conventional air convection cooling systems. Alternatives are water-cooled heatsinks that employ microchannels to maximize the heat transfer coefficient between IC and cooling system.

Recently, topology optimization – an optimization technique originating from structural mechanics – was successfully employed to design novel, unconventional microchannel geometries for watercooled heatsinks, thereby maximizing the heat transfer coefficient while minimizing the pressure drop across the heatsink. This project aims to revise the existing design of a microchannel-based heatsink with topology optimization in COMSOL Multiphysics to enable cooling of advanced chip generations.

In this thesis, you will:

- ✓ Set up and run conjugate heat transfer simulations in COMSOL Multiphysics to study the behavior of an existing heatsink.
- ✓ Learn the fundamentals of topology optimization.
- ✓ Apply topology optimization to heatsink design.

Required skills:

- ✓ Good mathematical and physical understanding, ideally with background in optimization techniques.
- ✓ Preferably, first experiences with finite element simulation software such as COMSOL Multiphysics.
- ✓ Curiosity, open-mindedness, high level of motivation.

What we offer:

- ✓ Dedicated supervision.
- ✓ State-of-the-art equipment.
- ✓ Impactful research.

Fields of Work

Finite Element Simulation, Thermal Management of Electronics, Optimization

Course of studies

Electrical Engineering, Mechanical Engineering

Start

As soon as possible

Duration

3-4 Months

Contact person

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