high tech institute

Electronics cooling thermal design

Price: € 1,425.00 excl. VAT

Duration: 5 consecutive half-day sessions

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Objective

The online courses focus on recognition and prevention of thermal problems through optimal thermal design and architecture choices in all stages of the industrial product creation process - avoiding re-design, delayed time-to-market and associated costs in time and resources. They give concrete guidelines to make the right thermal design choices on component, module and system level.

After the online course, the participant:

- has obtained a basic understanding of heat transfer phenomena;
- knows how to apply this knowledge in practice;
- is able to make the right thermal design choices on component, module and system level;
- knows to estimate when a thermal expert needs to be consulted;
- is able to communicate with thermal experts;
- is able to estimate the impact of system architecture, mechanical dimensions, material properties and heat dissipations on critical temperatures;
- is able to assess in-house or outsourced thermal computer simulations;
- knows the embedding of 'thermal design and cooling of electronics' in a system engineering context;
- has obtained an active skill level in thermal system design.

Intended for

Engineers (electronic, mechanical/mechatronic, reliability) directly involved with thermal design and cooling of electronic components, modules and systems, engineers confronted with thermal problems/issues, Thermal Engineers, System Architects, or those who want to understand and learn more about this subject of growing importance due to the electronification of society, be it automotive, LEDs, Internet-of-Things or data centers.

Prerequisites: technical college/university education.

For online module Advanced cooling of electronics, it is required that online module Electronics cooling thermal design has been attended.

Certification

Participants will receive a High Tech Institute course certificate for attending this workshop.

Trainers

Wendy Luiten MSc

Program

To allow for sufficient time to digest new information and gather hands-on experience, the course is scheduled for 5 half days of online training in the afternoon and enriched with homework assignments that can be attempted in the evening and following morning and will be discussed and demonstrated during the following online afternoon lesson.

The content is based on electronics cooling in a system engineering context, following the well-known V model of system level – subsystem level - component level, requirements flow down and capabilities flow up. Application of the system engineering concepts to the thermal domain and physics of heat transfer will be demonstrated and practiced.

Training time is divided roughly equally over theory and practice. Practice sessions will take the form of try-it-yourself exercises, followed by step-by-step guidance and demonstration.

Participants do not need to be familiar with thermal computer simulations or have access to simulation software. All training exercises are spreadsheet (Excel) based. Thermal computer simulations will be demonstrated using commercially available CFD (Computational Fluid Dynamics) codes, but the concepts are also applicable to FEM (Finite Element Method) thermal codes.

The training material includes worked versions of the exercises.

The program of the training is as follows:

- Introduction, Thermal systems engineering, V model and applicability to electronics cooling, Physics of heat transfer: conduction, convection, radiation, heating and cooling;
- Conjugate heat transfer, Heat sinks, Fan cooling, Water cooling;
- Introduction to Thermal measurements. Specifications and requirements. Thermal rules of thumb. Thermal Ways of working. Step-by-step thermal problem solving. Guided exercise and Demonstration of step-by-step plan;
- Step-by-step strategy for new thermal designs. Limitations of spreadsheet models. Thermal computer simulations. Guided exercise on system level new design, followed by a demonstration of the same case using computer simulations. Question and Answer. Introduction of a case study;
- Cooling solutions. Discussion of the case study. Guided step-by-step solution of the case study. CFD verification.

Methods

Online lectures by Microsoft Teams, exercises, demonstrations, homework assignments, guided exercises and case study.

Course material: electronic (compressed and copyrighted) lecture notes, booklet Heat Transfer Theory applied to Electronics Cooling by Lasance & Luiten.

Intro

Rationale
Industry moves towards ever increasing functionality, performance, miniaturization and less cost, resulting in higher heat densities and corresponding higher temperatures. Unfortunately, these have a negative impact on the performance, reliability and lifetime of electronic products, making thermal design more challenging than ever.

Optimization of thermal design is relevant for many electronic applications, such as consumer electronics, semiconductors, power electronics, LED applications, automotive, data centers, internet of everything, digital twins etc.

Two very experienced lecturers, Wendy Luiten (winner of the prestigious Harvey Rosten Award 2014) and Clemens Lasance (a.o. SEMI-THERM THERMI Award winner in 2001), teach the participants how to solve the thermal problems inherent in electronics thermal management today. Based on a combined 75-plus years of industrial thermal design experience, they present a balanced mix of theory and practice.

The Classic offline/classroom version of the 3-days 'Thermal design and cooling of electronics workshop' has been extended with two online courses:
- Online module: Electronics cooling thermal design (lecturer: Wendy Luiten);
- Online module: Advanced cooling of electronics (lecturer: Clemens Lasance).

We kept the renowned world class trainer team, and the excellent and high-quality contents. We addressed feedback from our previous trainings to:

- split up the thermal design part and the advanced cooling topics part;
- add much more time to digest the theory;
- provide more opportunities for hands-on practice.

The thermal design part is extended by two half days, with more opportunities for practicing and achieving an active skill level for designing new thermal applications, evaluating existing thermal applications, and assessing computational simulation models. The advanced part builds on this foundation and is scheduled several weeks later. This provides more time to get familiar with the material and facilitates the uptake of the advanced material.

To allow for sufficient time to digest new information and gather hands-on experience, the course is scheduled for 5 half days of online training in the afternoon and enriched with assignments to be made during the course and followed by a discussion and demonstration (if applicable).

The course can also be organized in-company, adapted to local needs.