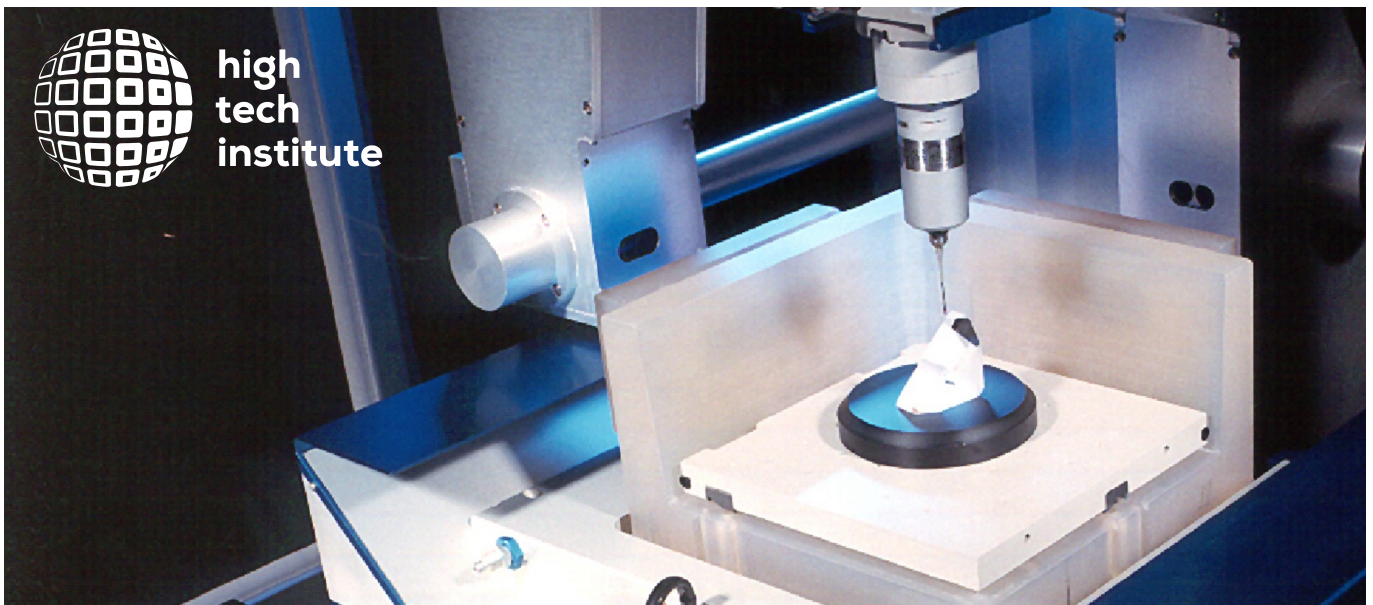


TRAINING BROCHURE

Thermal effects in mechatronic systems training



[Provisional reservation >](#)

[Book now >](#)



Thermal effects in mechatronic systems

- Price:** € 2,485 excl. VAT *
- Duration:** 3 consecutive days
- Contact:** training@hightechinstitute.nl, +31 85 401 3600
- Score:** 8.7 ★★★★★☆

Intro

This course focuses on the various aspects related to thermal effects that impact the performance (accuracy, life time or process quality) of precision modules/systems. Participants will acquire theoretical and practical background on design, simulation, measurement and compensation techniques that are essential in the development of precision modules/systems that are subject to internal or external thermal loads.

PRACTICAL INFO

- *If on-site training is not feasible, we will transition to a live, interactive online (virtual) or hybrid format. If this transition is necessary, we will contact you in advance for your approval.*
- *The training is also available for in-company sessions.*

Objective

After completion of the course, the participants understand the basic aspects, risks and concepts related to thermal effects and judge solutions and implications on system level.

Intended for

This course is intended for mechanical designers, mechatronics system engineers and mechatronic architects who are involved in the multi-disciplinary development of accurate motion modules/systems in which thermal aspects play an important role in the overall system performance.

Prerequisites: Technical education (BSc or higher), with at least two years of experience and preferably completion of the course "Mechatronics system design" (Metron Part 1), the former Philips-CTT course Metron or equivalent basic knowledge. Basic knowledge of matrix calculus is recommended but not essential.

Certified by



Certification

This course is certified by [the European society for precision engineering & nanotechnology \(euspen\)](#) and [the Dutch Society for Precision Engineering \(DSPE\)](#) and leads to the [ECP2-certificate](#).

Course leader

[Dr. Adrian Rankers](#)

Trainers

[Dr. Theo Ruijl](#)
[Marco Koevoets MSc](#)
[Dr. Rob van Gils](#)

** Prices are subject to change. Price correction will be applied at the end of the year.*

Keep me posted >

Program

Day 1

Basics: Thermal System Theory

- Common Heat Source in Mechatronic systems;
- Heat transfer mechanisms;
- Thermally induced deformations;
- Transient effects.

Basic Modelling

- Lumped mass modelling;
- Tooling;
- Electrical analogy;
- Hands-on exercise.

Day 2

Temperature Measuring / Thermal Experiments

- Precise thermal measurement techniques;
- Sensors;
- Do's & don'ts.

Case Cryogenic Application

- Lumped mass modeling;
- Simulation.

Design for Thermal Stability

- Main objectives and design considerations for precision equipment;
- Thermal centre, thermal cancelling & shielding (low-pass, reduction of gradients);
- Case: applying shielding.

Day 3

Active Thermal Control

- Frequency-thinking for thermal systems;
- Thermal feedback control design;
- Bandwidth estimation design rule;
- Prediction performance of module under control (optional).

Advanced Topics

- Model reduction;
- Thermal modes;
- Thermal compensation & sensor placement.

Read the interview:



Dr. Theo Ruijl (Trainer)

"There exists no accurate machine without good thermal management."

Remarks from participants:

- "Lots of useful information applicable to various scenarios. Nice with broad range of other course participants." > Erik Arlemark - ASML
- "Most important items I've learned: Lumped mass modelling principle." > Tom Schakenbos , ASML
- "Most important items I've learned: Lumped mass. Sensors." > Tim Meesters , ASML