

# The high-tech course for optics and mechatronics

Source: Fred Kamphues



The summer school is the place to be if you are: working in the field of precision engineering and if you want to learn and experience from expert designers: how to design opto-mechanical instruments that are actively controlled, operating in the non-perfect environment.

The scope of the summer school is to learn about the system design of optical instruments, based on fundamental knowledge of optical design, mechanical design and actively controlled systems. These systems typically include semiconductor equipment, metrology systems, microscopes, printers, space instruments and high-tech production equipment.

# Summer school Opto-Mechatronics

Precision  
Technology

Source: Fred Kamphues



## Summer school

Summer school Opto-Mechatronics gives a system overview in a 1 week course. In a case based course core disciplines are introduced.

System  
Engineering

Optics

Control

Opto  
Mechanics

Mechatronics

### Organisation

The Dutch Society for Precision Engineering (DSPE), is a branch organisation in which over 100 Dutch companies are represented. Our scope is a strong and competitive precision industry in Netherlands and abroad, which can only be achieved by an outstanding technology as well as a strong network on all levels. Therefore we organise a wide variety of activities.

The DSPE has an outstanding journal of Precision Technology Mikroniek, a site [www.dspe.nl](http://www.dspe.nl) comprising an impressive database of all the actual information with respect to precision in Europe. We have an active young precision engineers network (YPN) with engineers with 0 - 5 years working experience, an advisory board consisting of key persons within the Dutch Precision Industry. We organise networking and training events like summer schools, winter schools or theme days on a variety of subjects related to precision technology.



# Programme

## 5 day programme

### “The BIG picture” & Systems Engineering

Rob Munnig Schmidt (TU Delft)  
Friso Klinkhamer (Fugro)

The first day of the summer school will focus on the systems engineering aspects of product development and discuss the optical delay line of ESO's Very Large Telescope in respect of:

- **Requirement management**  
The technical requirements will be discussed, first order feasibility assessment and uncertainties.
- **Conceptual system design**  
Brainstorming concepts that are ranked in a trade-off, using the performance requirements as one of the criteria and an assessment of the development risks as another.
- **First elaboration of preferred concept**  
Assessment of concept performance and risk using first-order analysis, including mitigation and back up.
- **System breakdown/budget flow**  
For the positioning accuracy requirements, with top-down identification of contributors to this budget and definition of sub-budgets.
- **Verification**  
Verification of the requirements and the main verification methodologies are presented.

### Optical Design

Stefan Baumer (Philips)  
Eddy van Brug (TNO)

The optics day will consist of two parts: an overview of the optical aspects of a delay line followed by an introduction to optical design approaches. In the afternoon, the design approaches will be put into practice. In small groups under the guidance of experienced optical designers, the participants will design an optical delay line. Concluding the optics day, you will work with the optical design programme Zemax. A detailed discussion on the simulation results will be given.

### Control Design

Pieter Nuij (TU Eindhoven)  
Niek Doelman (TNO)

In control technology terms the optical delay line can be seen as a linear motion system. A tutorial of principles

and methods of motion control will be given, with special attention paid to the typical control challenges of delay lines: servo behaviour, vibration disturbance rejection, sensor noise and closed-loop stability. The participants will put motion control theory into practice by undertaking design exercises for a delay line.

### Opto-Mechanical Design

Jan Nijenhuis (TNO)

Mechanics plays a dominant role in the design of a delay line. Apart from putting things together high quality mechanics will guarantee best performance in terms of optical quality/stability and control performance. Lightweight and stiff structures are therefore crucial in achieving this goal. The design of the existing ESO delay line will be used to explain the requirements for such a structure. Emphasis will be put on the interactions with the other key technologies needed (optics, control and electronics) and on the mechanical design itself. During the second part of the day the participants will be challenged to participate by designing a specific part of the cat's eye (optical section of the delay line) using their own experience and the information provided earlier during the day. This will be done in teams of approximately five.

### Actuation, Sensing & Dynamics

Rob Munnig Schmidt (TU Delft)  
Adrian Rankers (The High Tech Institute)

For the last day some still missing elements will be presented that are necessary to realize high performance active positioning and control systems for optics. First of all an overview is given on electromagnetic and piezoelectric actuators, optical position measurement systems and capacitive sensors. Further also attention will be given to the performance determining mechanical system dynamics and vibration isolation. The new field of adaptive optics will also shortly be touched upon.

### Evening programme

- Experiences with the very large telescope (Frederic Derie (ESO))
- Systems engineering and wafer steppers (Frank de Lange (ASML))
- Active informal summer programme



## What do we offer?

Five days of intensive hands-on training, taught by excellent Dutch professors and scientists in the field of precision technology, that work at TU Delft, TU/e, ASML, TNO, Philips, ESO and The High Tech Institute.

Potentially a lifelong contact with the colleagues and educators from the course, that enables you to perform much better in the future. By simply contacting each other for support you will be helping each other to create the instruments of the future.

## Target group

Engineers working at academic level with a background in physics, mechanics, electrical or control engineering. Engineers that are experiencing the limits of their discipline and want to learn more about designing a complete opto-mechatronic system.

Colleagues will come from many different interesting universities and companies like ASML, Philips, Zeiss, Heidenhain, Jenoptic, EADS and high-end small enterprises.

To encourage contacts with your course members, social meet-and-greet events will be organised.

## Date and location

The summerschool 2012 will be jointly organized by DSPE and The High Tech Institute from June 25 to June 29, 2012. It will be hosted by TNO at its premises on the TU/e campus in Eindhoven. The programme starts each day at 9 am.

### Address:

TNO Science and Industry  
De Rondom 1  
5612 AP Eindhoven  
The Netherlands

## Online registration

Due to the interactive character of the course, registration is for the entire programme. Attendance is limited to 40 persons. Registration closes on 1 June 2012 or when attendance reaches 40, whichever is first. If you are unable to attend, a colleague can attend for you. Once you have registered, cancellation is no longer possible. The DSPE reserves the right to alter the programme due to prevailing circumstances.

### Registration:

[www.summer-school.nl](http://www.summer-school.nl)

Organised by:



Contributions from:



Hosted by:



## Fee

The fee will be 2995 euros per participant. This includes course file, lunch on all days, dinner on Monday, Tuesday and Wednesday, and an evening activity on Wednesday. The fee is exclusive of value added tax and accommodation. DSPE members are entitled to a 10% discount.

## Information

[www.summer-school.nl](http://www.summer-school.nl)  
[info@DSPE.nl](mailto:info@DSPE.nl)