

# Summer School Opto-Mechatronics 2010

***Following the success of the Summer School Opto-Mechatronics 2008 and 2009, the Dutch Society for Precision Engineering (DSPE) and TNO Science and Industry decided to organise a Summer school again. The Summer School Opto-Mechatronics 2010, from 5 July to 9 July in Eindhoven, once again is the place to be for anyone working in the field of precision engineering and wanting to learn and experience from experts how to design opto-mechanical instruments that are actively controlled, operating in the non-perfect environment.***

The Summer school Opto-Mechatronics 2010 comprises five days of intensive course, taught by excellent Dutch professors and scientists in the field of precision engineering, combined with hands-on training by TNO specialists. Participants will come from universities and high-tech large companies and SMEs. The programme includes social events. Venue for the Summer school is TNO Science and Industry at the university campus in Eindhoven, the Netherlands.



VLT at Paranal

ESO PR Photo 43a/99 (8 December 1999)

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Case work during the Summer school is done on the design of an optical delay line, such as the one developed by Dutch Space and TNO, for the ESO Very Large Telescope (VLT) on Cerro Paranal in Chile.

## **Programme**

The preliminary course programme outlined below each day offers a combination of theory and practice.

### *Monday 5 July: Systems Engineering*

Opto-mechanical instruments always co-exist with other equipment. So, before starting their design, the essence of the systems engineering has to be considered. What is critical and what are the margins? How to approach such a project and how to gain insight in the background of the requirements?

### *Tuesday 6 July: Optical Design*

The case starts with an introduction to the optical design and its use in optical aperture synthesis applications. Next, in teams, several delay line designs will be compared, in order to select the best design with respect to the optical requirements. Also, an effective optical design has to be found for measurement of the optical path differences. Zemax will be used to analyse the optics in the delay line.

Further work pertains to wave-front analysis and pupil imaging while moving the delay line, and assessment of alignment accuracy.

*Wednesday 7 July: Control Design*

Based on the functional requirements of the optical delay line, the challenges for control will be discussed. These include actuation for a high dynamic range, servo behaviour, vibration rejection, sensor noise, closed-loop stability and others. An introduction of suitable control design methods is presented to achieve nanometer positioning accuracy.

*Thursday 8 July: Opto-Mechanical Design, statically*

The trade-off made for a linear guiding of 66 metres, with sub-millimetre accuracy, will be presented. The students are requested to design and assess, in a team effort, the performance. The finite-element method programme ANSYS will be used to gain insight in the mounting of (aberration-free) optical components, and some smart construction principles.

*Friday 9 July: Mechatronics*

Designing an actively controlled delay line that is stable enough to perform interferometry over large distances, is far from trivial. 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.



Impression of the 2009 summer school.

Information and registration

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