

JOINT INITIATIVE OF DSPE, LIS ACADEMY AND THE HITTECH GROUP

At the recently held Holland High Tech Event, representatives from the Dutch high-tech industry emphasised the need for combining forces to stimulate export growth in the coming years. Well-trained engineers are essential to supporting these ambitions, including their know-how on manufacturability. These days, however, graduates of bachelor's and master's degree programmes in precision engineering have limited knowledge of manufacturability. This article outlines the relevance of manufacturing knowledge of young professional engineers and presents the joint Summer School on Manufacturability initiative.

ERIK KNOL AND PIETER KAPPELHOF

In the Netherlands, higher education programmes have strong track records in precision engineering (e.g. motion control, opto-mechatronics, and also ultra-high and ultra-clean vacuum technologies). However, the current bachelor's and master's programmes in precision engineering pay rather limited attention to manufacturability and production technologies. Of course, new and innovative technologies such as ALM (additive layer manufacturing) or ECM (electrochemical machining) are addressed. But, it is more important to educate students in manufacturability in relation to widely and intensely used metal-oriented manufacturing technologies such as milling, turning, and casting. These technologies should be a major part of the knowledge base of young professional engineers.

Relevance of expertise

The relevance of know-how on manufacturability of young professional engineers is expressed by means of "design for manufacturability" (DfM). DfM "involves the simultaneous considering of design goals and manufacturing constraints in order to identify and alleviate manufacturing problems while the product is being designed, thereby reducing the lead time for product development and improving product quality" [1]. We feel the need to indicate that good DfM

practice is facilitated when young professional engineers experience manufacturability. In our opinion, theoretical knowledge and tools such as "Computer Aided Manufacturability Analysis" should be complemented with real-life demonstrations and practice.

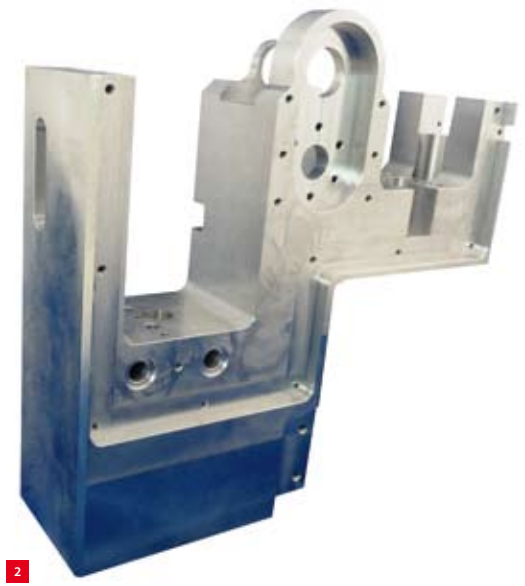
Summer School

DSPE acknowledges the importance of improving the knowledge of young professional engineers on manufacturing technology. Therefore, it has initiated a Summer School on Manufacturability organised by and held at the LiS (*Leidse Instrumentmakers School*, Leiden Instrument Makers School). The LiS's involvement is exemplary for the drive to strengthen its vocational education programme in precision technology and enhancing its activities in engineering projects for and with students (LiS Engineering) and in professional courses (LiS Academy).

Recently, the Dutch national government rewarded the LiS with a 5-year grant for its educational plans in a public private partnership collaboration with parties such as Hittech Multin, Demcon, Medtronic BRC, TNO, TU Delft and VUmc. The summer school perfectly matches LiS Academy's scope and facilities for the education of professionals.

AUTHORS' NOTE

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- 1 Optics table in a PCB (printed circuit board) mask printer; an example where redesign from a machined into a casting product led to cost reduction and increase in performance. (Photo courtesy of Hittech Group)
- 2 Precision component manufactured by milling. (Photo courtesy of Hittech Group)
- 3 Stainless steel frame made by metal sheet working. (Photo courtesy of Suplacon)

Metal working

The summer school is a five-day course (27-31 August 2013) in Dutch for young professional engineers with limited manufacturability know-how. Milling, turning, grinding, electro-discharge manufacturing (EDM), casting and sheet metal working are the technologies presented and discussed. Many of these technologies have been used for centuries, but nevertheless are still evolving in terms of accuracy, materials that can be processed, or speed of production.

Casting and sheet metal working may be applied less in the manufacture of low-volume and high-complexity products such as photolithography machinery and electron microscopes. Most Dutch universities of technology and universities of applied sciences no longer educate students in casting and sheet metal technologies. Nonetheless, these technologies generally offer unknown possibilities for the production of complex products and in some cases lead to cheaper or faster production compared to other technologies.

The purpose of the summer school course is to provide in-depth insights into manufacturability rather than offering a general overview. For this reason, the current course skips topics such as etching, ALM or component production from new materials (including ceramic or fibre-reinforced products) and focuses on milling, turning, grinding, EDM, casting and sheet metal working.

Company visits

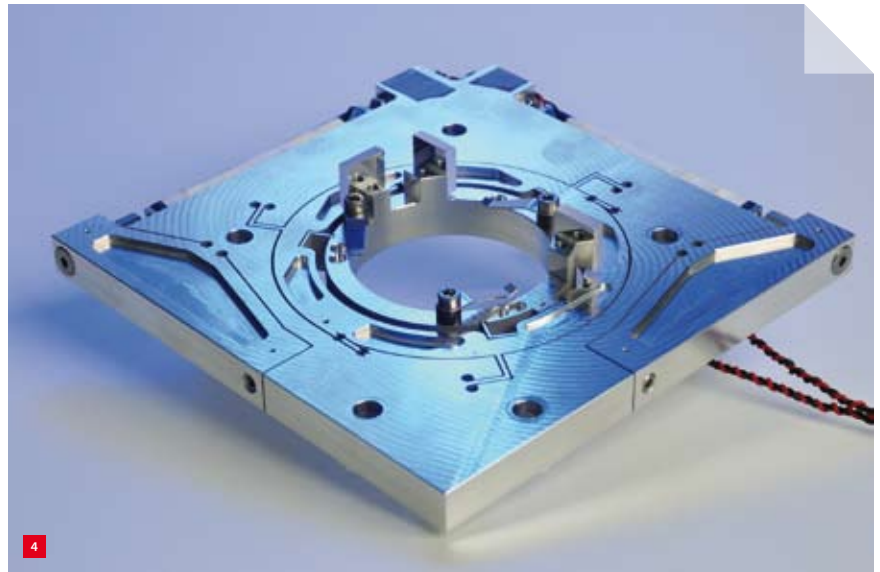
Hittech Gieterij Nunspeet, in Nunspeet, the Netherlands, will be visited for a casting lecture and to see metal casting in practice. Casting is a technology of economic interest for small series of about 20 objects. Applications have shown that

casting is a relevant, simple manufacturing alternative to reach, for example, higher stiffness, lower weights, lower unit costs, fewer assembly steps, and greater freedom of design.

In addition, Suplacon in Emmeloord, the Netherlands, will be visited for an in-depth lecture and guided tour with demonstrations in sheet metal manufacturability. Sheet metal production is known for its cost reduction possibilities compared to other production techniques and is often presented as a means to “light and stiff” design. It is not often used on a smaller scale, mainly due to lack of knowledge.



4 Scan stage for an electron microscope, as an example of an EDM-manufactured product. (Photo courtesy of Hittech Group)



Course programme

On each course day, one or two production technologies will be explained to participants in three ways as shown in the table below.

Morning lectures will focus on manufacturing aspects and relate them to design and engineering processes. These lectures will be given by LiS, TNO, Hittech Group, Hembrug and other organisations. Participants will learn basic design rules and their history. What is the draft angle of a casting product? What is the relationship between bending angle versus sheet metal thickness? When to use wire-cut EDM, taking into account slit widths and wire thickness?

In the afternoons, these techniques will be demonstrated in practice or experienced by the participants themselves. Milling, turning and EDM will be demonstrated at the LiS, and casting and metal sheet working during the company visits.

Finally, in the evenings, informal group discussions will be facilitated by senior experts (in research instrument making, production engineering, etc.). Participants will be encouraged to share examples of their own work experience. This interactive, friendly setting gives the participants the opportunity to refine their “lessons learned” on manufacturability.

Presentations, background material and manufacturability rules “you always wanted to know” will also be made available.

More steps to follow

The summer school is a small step in the process to enhance the knowledge on manufacturing techniques among young professional engineers. More initiatives to exchange knowledge in this field are very welcome. It is essential to continuously improve the awareness of manufacturability in order to design and produce products with higher added value at competitive prices. ■

REFERENCE

[1] Swift K.G. and Booker J.D., “Process Selection: from design to manufacture”. Butterworth-Heinemann, 2003.

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Preliminary schedule for the Summer School on Manufacturability (27-31 August 2013).

Day	Tuesday	Wednesday	Thursday	Friday	Saturday
Location	LiS (Leiden)	LiS (Leiden)	Hittech Gieterij Nunspeet (Nunspeet)	Suplacon (Emmeloord)	LiS (Leiden)
Technologies	Milling and turning (introduction)	Milling, turning and grinding (advanced)	Metal casting	Metal sheet working	EDM
Morning	Introduction and lectures by LiS and Hittech Group	Lectures by TNO and Hembrug	Lectures by Hittech Gieterij Nunspeet	Lectures by Suplacon	Lectures by LiS
Afternoon	Manufacturing demonstrations and practice	Lectures, manufacturing demonstrations and practice	Lectures, excursion and casting practice	Excursion and manufacturing demonstrations	Manufacturing demonstrations
Evening	Group discussions with senior experts	Group discussions with senior experts	Social event	Group discussions with senior experts	