

“Mechatronic engineers curious and

Mechatronics is hot in the Netherlands. Therefore, Dutch universities of applied sciences (Dutch abbreviation, HBO) intensify their efforts to deliver more and better mechatronic engineers. Avans Hogeschool in Breda was in 2009 the second HBO-institution in the Netherlands – after Fontys in Eindhoven – to appoint a lector in mechatronics. A special lectorate, because it even extends to the level of higher secondary professional education (MBO, in Dutch; HBO being the tertiary level). Mikroniek interviewed lector Jos Gunging about mechatronics in the Netherlands, his vision and his plans.

• Jan Kees van der Veen •

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Enthusiasm, openness and curiosity are words that characterise Jos Gunging. Although the interview takes place in a noisy room and is now and then interrupted by passers-by, Gunging manages to convey his message convincingly. He leaves the impression of a man fascinated by technology, with a clear mission that he is ready to communicate with anyone, anywhere, anytime. There is no hesitation in his answer to the first question.

“Are Dutch people good at mechatronics?”

“Yes! We are traditionally good in high-tech, look at successful Dutch high-tech companies like ASML, Océ and Philips. But, even more important, we are good at working together. We love ‘poldering’: debating, bargaining, helping each other, building something together. We flourish in teams, *interdisciplinary* teams with specialists from different technologies, or *interfunctional* teams with people from R&D, production,

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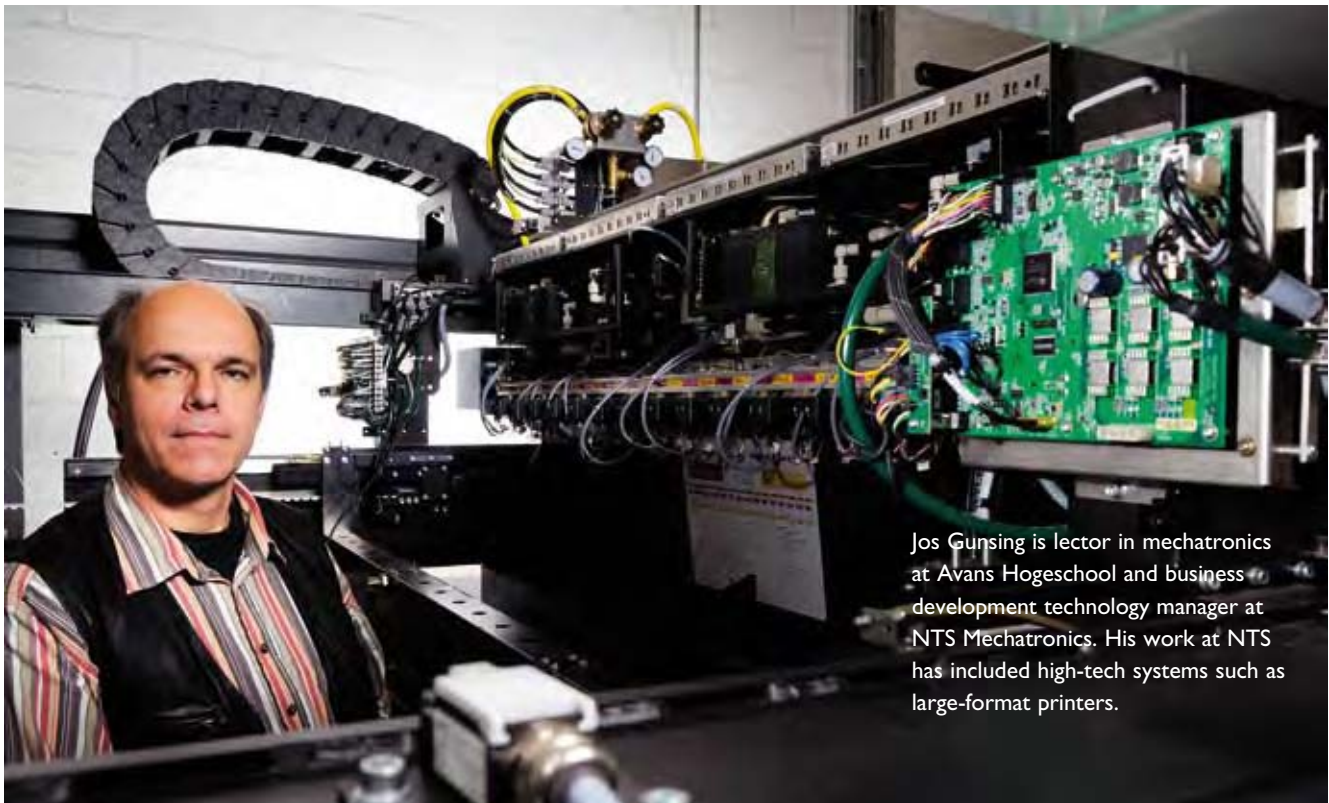
marketing, purchasing, etc. We like working in an ‘orderly chaos’ that challenges our creativity and perseverance. Therefore, mechatronics, a discipline that forces traditional bastions as mechanical engineering, electronics and informatics to open up and co-operate, is a perfect playing field for the Dutch. The other side of the medal is that we are not good at tightly planned, step-by-step, risk-avoiding development, such as in the automotive industry. This usually comes with bureaucracy and we hate that.”

Roadmap: robotics

Jos Gunging started in March 2009 on a part-time basis as lector at Avans Hogeschool in Breda. For two days a week he is still business development technology manager at NTS Mechatronics in Eindhoven, the Netherlands. At Avans he got the task to set up and lead a mechatronics research group. This lectorate now consists of five people, Gunging and four teachers, who do this work besides their regular teaching job. Gunging himself does not have a lecturing task.

Gunging realised, when he started, that his group – the lectorate – would have to restrict itself: mechatronics is too broad to cover with just five part-timers. What would be an

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Jos Gusing is lector in mechatronics at Avans Hogeschool and business development technology manager at NTS Mechatronics. His work at NTS has included high-tech systems such as large-format printers.

interesting area to focus on? He organised brainstorming sessions with companies participating in the lectorate to lay down a mechatronics technology roadmap for the coming 5-6 years, with the emphasis on robotics. After many discussions, he chose gripper technology as focus area for his group.

“Why gripper technology?”

“Grippers are essential in any robotic system, but there is huge diversity in the environments they are used in (production, logistics, healthcare, ...) and in the objects they pick up (boxes, plastic bags, wafers, electronic components, eggs, ...), hence the variation in gripper requirements is huge. Think of speed, accuracy, cost and development time. The requirements are getting tougher all the time, but still suppliers of grippers, all having their own niche of the market, hardly co-operate. Consequently, the wheel is reinvented over and over again. Our target is to

develop a family of grippers with maximum reuse of technology and knowledge.

The four people in my group are each responsible for a theme within gripper technology. The themes were selected in co-operation with regional mechatronic companies like Bosch Rexroth, CSi and Van Uitert, which will be involved in the forthcoming research projects. As the group is still in its start-up phase, concrete results of projects cannot be shown yet, but there will be in the near future.”

Themes

1) Vision in Mechatronics

“With the latest advancements in electronics and software, 3D vision now comes into reach, a promising technology in making grippers faster and more accurate. We are looking at low-cost solutions using FPGA technology. With Henk Kiela, lector in Mechatronics at Fontys Hogeschool, and Erik Puik, lector in Micro



In the Bernoulli gripper a high-velocity air stream is passed over the surface of a delicate, flat object, for example a solar wafer, so that the local pressure drops and the object is drawn towards the gripper. Avans students built a prototype. (Photo courtesy Bosch Rexroth Tech Centre Europe)

Systems Technology / Embedded Systems at Hogeschool Utrecht, we have submitted a joint request for subsidy of this activity.”

2) Force-steered gripping

“Grippers used for handling fragile or vulnerable objects cannot use fixed force, as the danger of damaging the objects is too high. They need force feedback, which means that force sensors are built in the ‘fingers’ of the gripper and that subtle control algorithms adapt the gripping force to the resistance of the object. This is still a tough challenge for mechatronic engineers. By the way, did you know that the holy grail in gripping is placing bags with potato chips in a cardboard box? The chips are not allowed to break as it causes ‘potato dust’ to accumulate at the bottom of the bag, which is commercially unacceptable.”

3) Mechatronic design methods

“Mechatronic engineers must be able to think at system level and to make a technology trade-off at the beginning of each project. For example, high-accuracy positioning can be done with high-precision mechanical components, but if production numbers are sufficiently high, it may be worthwhile building in position sensors and investing in the development of dedicated control software. We asked the Embedded Systems Institute in Eindhoven to help us building up knowledge for making such technology trade-off decisions.”

4) “Still to be defined, but a teacher has already been appointed.”

“Are you also involved in the mechatronics curriculum at Avans?”

“Yes, although the mechatronics group and the curriculum are separate activities. Avans Hogeschool offers, for a

number of technical studies, a four-year curriculum concluded with a Bachelor degree. In the past, students spent their third year within a company. This internship has now been shortened to a half year, to give the students extra time to follow broadening courses (‘minors’). Also new is that, during their internships, they come back to school once every two weeks to report for an audience of teachers and fellow students about their findings. This works very well.

Mechatronics is not an official study (yet), so Avans Hogeschool cannot offer it, but since a couple of years, students in mechanical and electrical engineering can opt for a mechatronics specialisation. They get a special package of courses, focused on mechatronics. In 2009, the school delivered 17 bachelors with a mechatronics specialisation and this year we expect 35 to 40. The mechatronic industry is happy with them; our graduates have no problem finding a job.

Together with three other universities of applied sciences – De Haagse Hogeschool, Fontys and Saxion Hogeschool – we have submitted a request to the minister of education to have Mechatronics officially recognised as a new study.



Avans student operating a mechatronic test set-up.

About lectureships or lectorates

Lectureships are a relatively new phenomenon in the Netherlands. Since 2002, the Dutch universities of professional education (HBO) have a research task in addition to their educational task. The research has to be application-oriented and directly driven by the needs of industry. The function of lector was created to strengthen the link between school and industry. Usually lectors are recruited from the industry and work part-time at school, part-time in the industrial company they come from. In this way, optimal use can be made of their professional network.

Lectureships bring advantages for the schools as well as for the industry. Previously, HBO teachers were more or less cut off from technological developments taking place in industry, and their knowledge tended to become outdated. Consequently, when students did internships and graduation projects at companies, teachers could do little more than monitor and guide the process as they were no content experts. This situation is now improving. The advantage for industry, in particular for SMEs, is that participating in research projects opens up new horizons, as it helps to look at the technologies of “the day after tomorrow”.

A strange thing about lectors (or lectureships) is that lectors do not lecture...

Recently, permission was granted, so that – after subsequent accreditation – we can start with the official Mechatronics Bachelor study in September 2011.”

“And you are involved in the MBO mechatronics curriculum as well?”

“Avans has many students coming in from higher secondary professional education (MBO), with a mechatronics diploma. They want to continue in mechatronics at the tertiary level (HBO), but up to now the connection was poor. Together with MBO colleagues from nearby Tilburg we try to create a smooth mechatronics learning trajectory for these students with as little gaps and overlaps as possible. MBO and HBO teachers are talking with each other on a regular basis now and both parties, as well as the students, benefit.

Noteworthy is that the MBO school in Tilburg, like us, has selected focus themes in mechatronics: vision, choice of materials, sustainability & energy consumption and ‘the practical understanding of physical concepts’. The last theme is quite challenging: it came from a rather alarming finding that students who learned about mass, friction, damping and other physical concepts have great difficulty envisioning these phenomena in real. They need much more practical instruction to get these insights. We are working on that.”

“What makes mechatronic engineers different from other engineers?”

“Mechatronics is an area where several disciplines meet. Mechanical engineering, electrical engineering and informatics of course, but also mathematics, man-machine interfacing, materials science, etc. Mechatronic engineers always keep the system view, but at the same time they must have sufficient knowledge of the underlying technologies to be able to make practical design decisions. They have to hop between two levels all the time. They have to be open-minded, curious and communicative.

Indeed, this makes them different from their M-, E- and I-colleagues.

This was radically different in the past. In industrial automation projects the mechanical engineers were always in the lead. The electrical engineers were called in to develop the electromechanical devices and the electronics to drive them. And when that was done, the software developers came in to ‘clean up the mess’ that could not be solved by their predecessors. This situation has now completely changed. All disciplines are part of the team from day one.

Recently, at Avans Hogeschool, Technical Informatics was brought together with Electrical and Mechanical Engineering in one department. The school is now in an excellent position to bring education in mechatronics to a new level.’

“What will the future bring for mechatronics in the Netherlands?”

“If we make the right choices, mechatronics has a bright future. To our policy makers I would say: do not fritter away your money and resources on projects with little future, but support the strong sectors, leave the weak sectors alone. Mechatronics is such a strong sector. Help Dutch companies excel in what they are good at. It is impossible to be good at everything in our small country. To the entrepreneurs I want to say: dare dreaming of the future now and then, look further ahead than tomorrow. And always be prepared for change. The entrepreneurs I can best talk with are the ones who can switch smoothly between the short term and the long term. I admit, though, that there is still some mission work to be done!”

Information

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