

PRECISION IN VENICE

This year, euspen's International Conference & Exhibition was held in Venice, Italy, at the Venice Terminal Passeggeri (VTP). The venue in arguably one of Italy's most iconic cities afforded striking views of the Venice lagoon, and the beautiful weather and scenery provided the backdrop for what many have described as the most successful euspen annual event ever to be held.

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About euspen

The European Society for Precision Engineering and Nanotechnology (euspen) is an influential community linking industrialists, researchers, respected authorities, and new and established players worldwide. It provides an entrepreneurial platform that enables companies and research institutes to promote their latest technology developments, products, and services and keep up to date with those in the field. euspen's defined mission is to advance the arts, sciences and technology of precision engineering, micro-engineering and nanotechnology; to promote its dissemination through education and training; and to facilitate its exploitation by science and industry.

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The 18th euspen International Conference & Exhibition in Venice (Figure 1) attracted nearly 400 delegates from across the world and 34 exhibitors. Overall the event hosted 206 organisations, from 22 countries, the content of the event consisting of 235 submissions from 167 organisations.

The key to the euspen annual event is networking. This is a gathering of leading academics, researchers, and industrialists all with an acute focus on advancing the discipline of precision engineering and micro/nano-scale manufacturing. The event has over the years become synonymous with alerting attendees to the latest cutting-edge developments and next-generation solutions that exist in the precision engineering environment.

The five days of the event catered for all levels of understanding and involvement in the precision engineering sector, and this year the event kicked off on day one with some lively workshops and tutorials that focused on the key

1 The 18th euspen International Conference & Exhibition was held in Venice, Italy. Here, the Canal Grande and Rialto Bridge are depicted. (Photo: Martin Falbisoner/Wikipedia)





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issues of concern to all working in the micro- and nano-manufacturing environments. Topics covered included the fundamentals of precision design, optical measuring technology, dynamics and control of mechatronic systems, design in ultra-high vacuum, flexure design in mechatronics, cutting tools, and the EU dissemination project “Geometrical Product Specification & Verification Toolbox” (GPS&V).

Conference

The basic structure of the conference covered the key areas of critical concern to the precision engineering community, the first day this year being kicked off with two keynote addresses.

Professor Piero Martin (Figure 2a) from the University of Padua, Italy, focused on the status, challenges and perspectives of the research on magnetic confinement nuclear fusion, i.e. that approach to fusion where the fuel in the plasma state is confined in a toroidal vacuum chamber by a magnetic field. In the quest for sustainable global energy scenarios controlled thermonuclear fusion represents an important option. Fusion, the process that drives the sun and the stars, is clean, carbon-free, safe, does not contribute to nuclear proliferation and uses fuel, which is abundant and ubiquitous like water and lithium. The magnetic confinement nuclear fusion flagship project is ITER, an experiment which is designed to demonstrate the scientific feasibility of this type of fusion and is under construction in France.

The second keynote address, entitled “Mechatronics disrupted?”, was delivered by Professor Maarten Steinbuch (Figure 2b) from Eindhoven University of Technology, the Netherlands. In next-generation high-tech and mechatronic systems, extreme functionalities and performance requirements demand a multi-physics systems approach. The control systems will become adaptive, auto-tuned, will be implemented in optimised hardware and software architectures, and will employ effective (wireless) communication. The field of robotics could be treated as a separate research area, next to mechatronics, but for

instance the speed requirements of industrial robots or the accuracy requirements of surgical robots necessitate the inclusion of the description of dynamical behaviour of the robots. Where does mechatronics end and robotics start?

Steinbuch: “Overseeing the developments we could question what mechatronics actually is or will be. Is mechatronics being disrupted? Has it evaporated already into systems engineering, is it part of the supporting disciplines, does it enlarge to be the backbone of cyber physics? Moreover, if biological systems are also going to have technical devices implemented (internet of humans), what is then the role of the mechatronics discipline?”

The conference sessions over the course of the three-day event looked at advances in precision engineering, design and performance of measuring instruments and machine tools, mechatronics and control, replication and additive manufacturing, mechanical manufacturing processes, non-mechanical manufacturing processes, and metrology.

This year, prominent among the high-calibre presentations was the one by Patrick Bointon from the University of Nottingham, UK, which precipitated a lot of interest as he discussed the effects of vibration on fringe projection systems, and a paper by Jun Qian from KU Leuven in Belgium that looked in-depth at ultrasonic assisted drilling of composites.

Exhibition

There was a real buzz around this year’s exhibition, and there were a number of new faces and new technologies on display. Notable among these were Ultrasion, Cytosurge, Kinetic Ceramics, and a company returning to the event after a while away, Alio Industries.

Ultrasion was showcasing its ultrasonic micro-moulding technology. To date, technology providers in the area of precision moulding have attempted to focus on adapting large-scale moulding technologies to micro-moulding applications. However, the inherent problems associated with moulding in general (and exacerbated at the micro-scale) have not been addressed. Moulding using the traditional screw, barrel, and heater band configuration means the preheating of materials in advance of injection into the mould. This means that the material degrades before injection, and this has huge repercussions when moulding on a micro-level.

The Ultrasion process eliminates residence time and hence material degradation by dosing only the amount of material needed per shot, which is melted via an ultrasonic horn right by the gate, reducing the thermal window to milliseconds. In addition, ultrasonics reduces the viscosity of the

2 Keynote speakers:
(a) Prof. Piero Martin,
University of Padua,
on magnetic
confinement
nuclear fusion.

(b) Prof. Maarten
Steinbuch,
Eindhoven University
of Technology,
on the current status
of mechatronics.

'euspen inside'

What is being discussed at the annual euspen conference is pushing the boundaries of what is already possible and is being achieved in industry today, and is incorporated in things that we take for granted every day. The organisers are working hard to ensure the link between the technical conference presentations and real world applications is reinforced. This is not an event where researchers are discussing issues concerning non-practical applications. Each and every paper is actually pushing advances in technologies and techniques that have real-world uses, and this link is being promoted through a new initiative that euspen is in the process of launching, called 'euspen inside'.

The idea of 'euspen inside' is to make clear the link between the work that euspen undertakes day-to-day as a society promoting the art of precision engineering, the presentations at its annual events and other seminars and workshops throughout the year, and the commercial use of micro- and nano-scale engineering in countless industry sectors. We are surrounded by real-time applications of the art of precision engineering in every walk of life, be it a trip to a hospital, a drive in a car, a flight in an aeroplane, or using our mobile phones. You name it, and micro- and nano-scale manufacturing is there, and the link between what may seem like rarefied discussion and research, and the real world is one that euspen will continually seek to demonstrate. In this way its events and initiatives will become more and more inclusive and pragmatic over time.

melted plastic, meaning that longer, thinner, flatter parts can be manufactured than ever before, stimulating innovation by knocking down design and manufacturing constraints.

Cytosurge was presenting its FluidFM µ3Dprinter, which is the world's first 3D printer capable of delivering submicron resolution in direct metal printing. Pinpoint additive manufacturing provides the possibility to print complex



3 Alio used the euspen event to announce the introduction of its Hybrid Hexapod.

metallic 3D µ-structures on existing objects and surfaces. The FluidFM technology allows a variety of materials to be combined within one object, and can be used to print micron-wide solid metal structures directly into or onto individual objects, as well as for the repair of tiny structures or electrically linking minute objects.

Kinetic Ceramics, one of the world's leading multi-industry precision technology companies was showcasing its range of piezo actuators used across numerous industrial applications. Details were also available of the company's proprietary Piezomotor®, made from PZWT-100 powder, and according to Kinetic Ceramics the highest performing piezoelectric actuator available on the market today. Over 20 years of research and development have been invested to create a material that provides up to 28,000 Newtons of force, 10 to 200 microns of displacement, and precision movement at nanometer resolution.

Alio Industries used the euspen Venice event to announce the introduction of its Hybrid Hexapod® (Figure 3) in response to the demand from industry for more and more versatile and accurate motion control systems. The Hybrid Hexapod® technology which Alio claims outperforms any other hexapod solution in the market could be a game-changer in the field of motion control, and may stimulate innovation as an enabler of next-generation manufacturing processes.

Other exhibitors included regular euspen supporters attocube, Huber, Cranfield Precision, Sensofar Metrology, Taylor Hobson, Zygo, and Precitech among many more. It is interesting to get first-hand feedback from exhibitors about how the event works for them. This is not an exhibition that exhibitors attend expecting a thousand new leads, but is rather a place where strategic, meaningful, and long-term alliances are forged.

William Meiklejohn from first-time exhibitor Kinetic Ceramics said, "We were very happy with the event, and we met a good number of new contacts which we will work with into the future." Marianne Janssen (Figure 4) from Janssen Precision Engineering (JPE) endorsed this view, and explained that the event was an annual fixture for them as it afforded the opportunity to have long and meaningful interaction with influential players in the precision engineering space, and to forge and mature long-term relationships. For Janssen, the euspen event is "less a place to sell products, and more a place to embed with companies' research projects".

This is an important aspect of the euspen event. In the area of precision engineering, technology and service providers like to forge relationships where they are seen as strategic



4 According to Marianne Janssen (JPE) the euspen event is “less a place to sell products, and more a place to embed with companies’ research projects.”

partners in product development, and the ability to integrate themselves with companies at the research stage of product development is obviously advantageous.

In many ways this is the reason that another seasoned euspen exhibitor, MI-Partners, keeps coming back. MI-Partners is an engineering consultancy company that creates new design concepts and delivers prototypes and one-of-a-kind equipment. The company is a development partner maturing measurement systems and precision equipment, and Ronald Timmermans, sales director, sees exhibiting at the euspen annual event as “a great opportunity to keep in touch with the engineering and science community that deals with these types of systems”.

Atsuko Nose from Mitaka Kohki also endorsed the value of the euspen event as a way of embedding with companies that were at the early stage of research with their analysis equipment, and Clive Warren, strategic business development manager from Renishaw (another regular exhibitor) highlighted another key value of conference and exhibition, namely that it was a great recruiting ground for prospective employees as it attracted the cream of Ph.D. students fronting research in precision engineering.

Posters

A key feature of the euspen annual event is the extremely vibrant and busy poster area. This year, the winner of the poster award was “Manufacturing uncertainty: How reproducible is the depth of cut during diamond turning of OFHC copper?” by Junguo Zhao, Claudiu Giusca and Saurav Goel from the School of Aerospace, Transport and Manufacturing, Cranfield University, UK.

In second place was “Experimental qualification of the strength enhancement of coated concrete parts” by C. Hahm, R. Theska, and D. Raab from Technische Universität Ilmenau, Germany, Department of Mechanical Engineering, Precision Engineering Group, A. Fehringer from Egbert Reitz Natursteintechnik, Germany, and A. Kästner from ETC-Products, Germany.

Third came “Accuracy of surface topography measurements performed by X-ray computed tomography on additively manufactured metal parts” from F. Zanini, E. Sbettega, and S. Carmignato from the Department of Management and Engineering, University of Padua, Vicenza, Italy and M. Sorgato from the Department of Industrial Engineering, University of Padua, Padua, Italy.

To conclude

The week was rounded off on the final day with a series of tours, this year to Consorzio RFX (a research organisation that performs scientific and technological research activities in the field of controlled thermonuclear fusion as a possible energy source), the Laboratory for Micro and Precision Manufacturing at the University of Padua, and Marposs, a leader in precision equipment for measurement and control in the production environment.

Finally, each year euspen hosts the Heidenhain Scholarships. The Heidenhain group has been associated with the euspen annual event for over ten years, and has provided over 100 scholarships to date, and was brought into a philanthropic foundation over 40 years ago with a philosophy to invest in research, development, social, and scientific projects. Scholarships are available for students or researchers registered for Masters/Ph.D. or equivalent courses at a recognised international higher education institution. Figure 5 shows the 2018 scholarship winners.

Next year, the euspen annual event will be held on 3-7 June in Bilbao, Spain. ■



5 The recipients of the 2018 Heidenhain Scholarship.