ECAS news

Newsletter of ECAS e. V.

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The European Adaptronics Network

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Activities in Adaptronics

The Latest from the Technological Field of Adaptronics

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- LCM: Trends in Hydraulic Drive Technology
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- CRF – Adaptronic 2010 The Piezo Institute

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Dear readers,

"Things are getting better" - a phrase we're hearing more and more now. In the machine engineering sector there's catching up to be done - of orders which were postponed in the past months, or cancelled or delayed. A positive economic climate like this naturally stimulates new opportunities for converting innovative ideas into products. Of course, a company must be selective when investing existing resources into activities designed to increase turnover, but it would be hardly be prudent to neglect the improvement and further development of their own products against the background of day-to-day business.

This newsletter aims to stimulate new impetus among appliers of new technologies, whether for developing new products or realising new concepts within the context of existing technology. Becoming a part of the ECAS Technologies Network will really give companies the edge when it comes to the implementation of innovation. The new ideas featured in this newsletter only represent a small fraction of what's available in the Network – many others have already found their way into products or are waiting to go into development. "The courage to think laterally" – what better motto could there be to suit the current situation?

Sincerely yours,
Dr.- Ing. Andreas Brosinger
Head of ECAS Main Office

Sensory and Active Clamping Systems

B. Denkena, H.-C. Möhring, O. Gümmer, K. Litwinski
Institute of Production Engineering and Machine Tools, Leibniz University of Hannover, Germany

Machining processes like turning, milling, drilling and grinding nowadays have to fulfill serious re-quirements regarding productivity, accuracy, reli-ability and efficiency. Sensory and adaptronic ma-chine tool components can provide the necessary functionality for monitoring and active adjustment of machining processes [1]. In this article, two workpiece clamping devices - one with integrated sensory and one with precise active positioning capability - are presented, which have been developed at the Institute of Production Engineering and Machine Tools (IFW) in Hannover. Beside the general tasks of clamping systems – to provide a certain work-piece position, to support the workpiece and to apply the necessary clamping forces during machining – these clamping systems can be used to gather process information and to influence the process conditions in autonomous adaptive loops.

Sensory clamping system

Within the Collaborative Research Centre "Gentelligent Components in their Lifecycle" (www.sfb653.uni-hannover.de) a modular clamping system for prismatic workpieces has been developed, which provides sensory capability for process moni-toring [2, 3]. A modular system-architecture has been realized in order to achieve the necessary flexi-bility to adapt the clamping configuration to various workpiece geometries (Fig. 1).

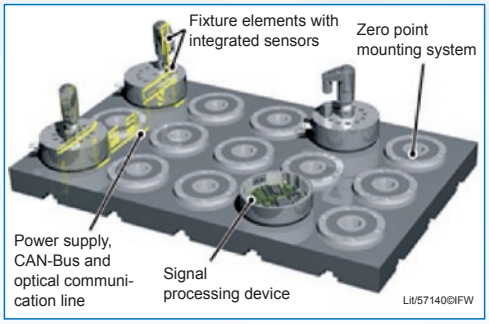

Fig. 1: Modular sensory clamping system

The system consists of a customizable base plate which carries zero point mounting elements. Depending on the workpiece requirements – regarding geometry and stiffness – clamping sockets can be mounted on these interfaces which again carry various fixture elements. The configuration of the fixture elements can be adjusted via a pattern of threads on top of the sockets. The fixture elements (e.g. contact pins, swing clamps, clamping claws) are equipped with different sensors (strain gauges, acceleration sensors, temperature sensors) in order to record relevant process data, see figure 2.

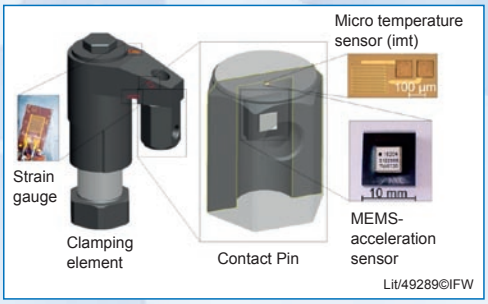

Fig. 2: Sensor integration

With the goal to achieve a high sensitivity of the sensors with respect to the machining process, a simulation based optimization strategy has been applied to select an appropriate sensor placement.
The whole clamping system has been integrated and tested in different machine tools. An example can be seen in figure 3.

Fig. 3: Integration into a machining center

During machining, process forces and excitations can be measured (Fig. 4). Together with e.g. a frequency analysis, different signal contents can be separated from each other. Thus, erroneous process states can be identified. Furthermore, the measured data can be used for process adaptation.

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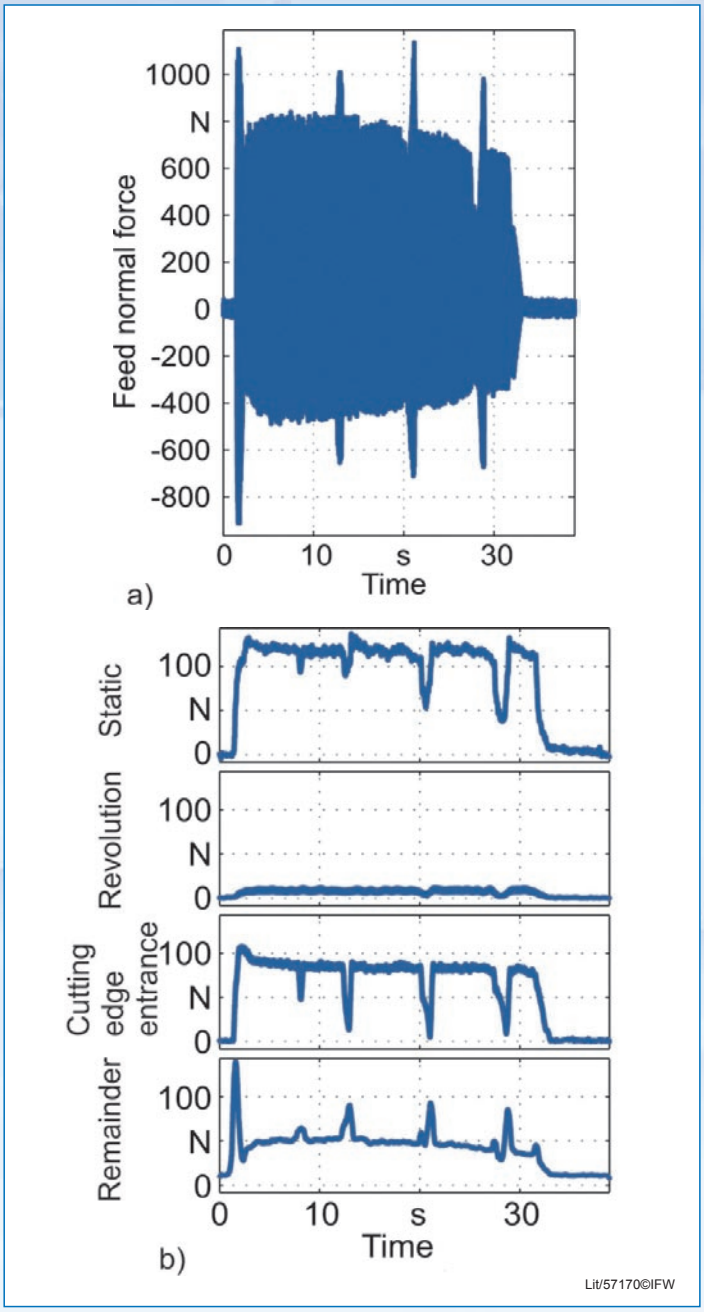

Fig. 4: Measurement results

Active rotary clamping system

Active rotary clamping systems (chucks) have been developed in the Collaborative Research Center „Process Chain for Production of Precision Forged High-performance Components“ (www.sfb489.uni-hannover.de, see also [4, 5, 6]).

The rough geometry of near-net-shape forged work-pieces usually does not possess the optimum allow-ance distribution for subsequent machining processes (e.g. turning and grinding). In order to align such workpieces during cutting operations, a precise positioning in up to 4 degrees of freedom (DOF) is necessary. In two directions, eccentricity can be compensated and by two rotational DOF, tilt errors can be minimized (Fig. 5). The actuation is realized by piezoelectric actuators. In order to identify the alignment set value, optical sensors are integrated into the machine tool together with the active chuck (Fig. 6, see also [6]). Thus the radial displacement and angular orientation can be observed.

Beside the compensatory alignment of workpieces the actuators can be used as additional drives in noncircular processing.

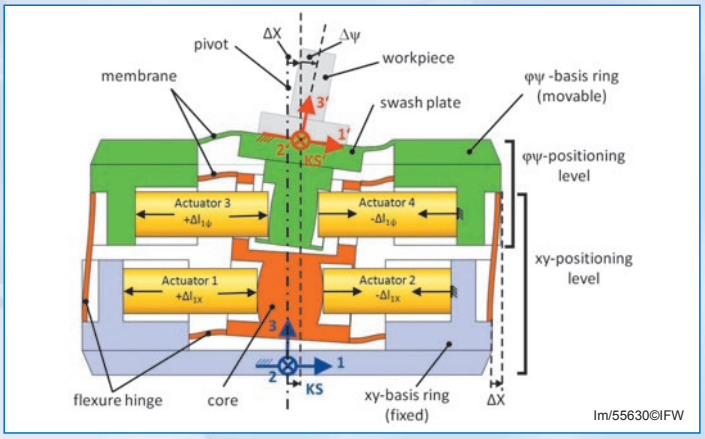

Fig. 5: Scheme of the 4-DOF active chuck

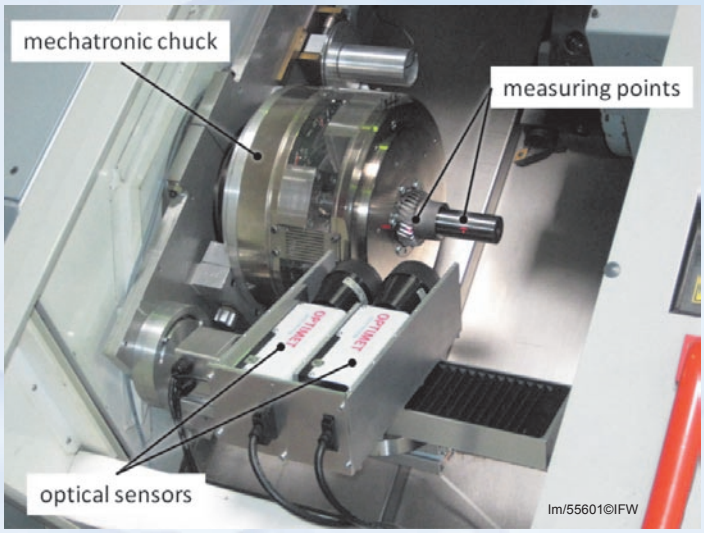

Fig. 6: Active 4-DOF chuck with optical sensors

Conclusion and Outlook

Sensory and active machine tool elements can pro-vide additional functionality for process monitoring and precise process adjustment. In this article, proto-typic components are presented which show the potential of the integrated technology. The next step is a transfer into industrial applications.

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Trends in Hydraulic Drive Technology

Bernd Winkler, Linz Center of Mechatronics GmbH

Currently, two strong trends dominate the innovation of hydraulic drives. The first are electro-hydraulic hybrid drives or integrated hydraulic drives. They combine modern electric servo-motors with a hydraulic transmission for an optimal use of both drive technologies' strengths and avoidance of their weaknesses. Such hybrids are currently already strongly penetrating the market, since all components are available and the basic concepts are mostly straightforward. Nonetheless, there is a potential for optimization by tricky solutions for specific applications.

The second trend are digital and switching hydraulics. These technologies operate by digital components only. These components are foremost switching (on-off) valves, but also digital displacement pumps and motors as well as digital hydraulic cylinders. With this matchbox of digital components numerous digital or switching hydraulic systems can be composed. The benefits compared to conventional continuously operating systems are better energy efficiency, higher robustness and reliability, lower cost, and excellent controllability. The novel core components of this new hydraulic branch are fast switching valves with switching times in the milliseconds range.

The effective and efficient realization of practical drives adopting one of these new principles asks for a strong alliance of electrical and hydraulic expertise. Experts of the Linz Center of Mechatronics (LCM) and the Johannes Kepler University of Linz work on the forefront of these technologies, both in research as well as in practical applications. Hydraulic and electric Experts from hydraulic and electrical drives work closely together to develop optimal solutions for industrial and mobile applications.

These teams apply optimization methods using complex mathematical models in their design work. These methods are not limited to conventional optimization techniques which seek one best solution based on one cost function but are addressing the true multi-criteria nature of any technical optimization problem. This results in a so called Pareto set of solutions. Each solution of this set exceeds any other at least with respect to one optimization criterion. This multi-criteria optimization approach in system optimization provides a much better view on the technical prospects and constraints than classical optimization methods. Such a method has been successfully applied to a fast switching valve for big flow rates.

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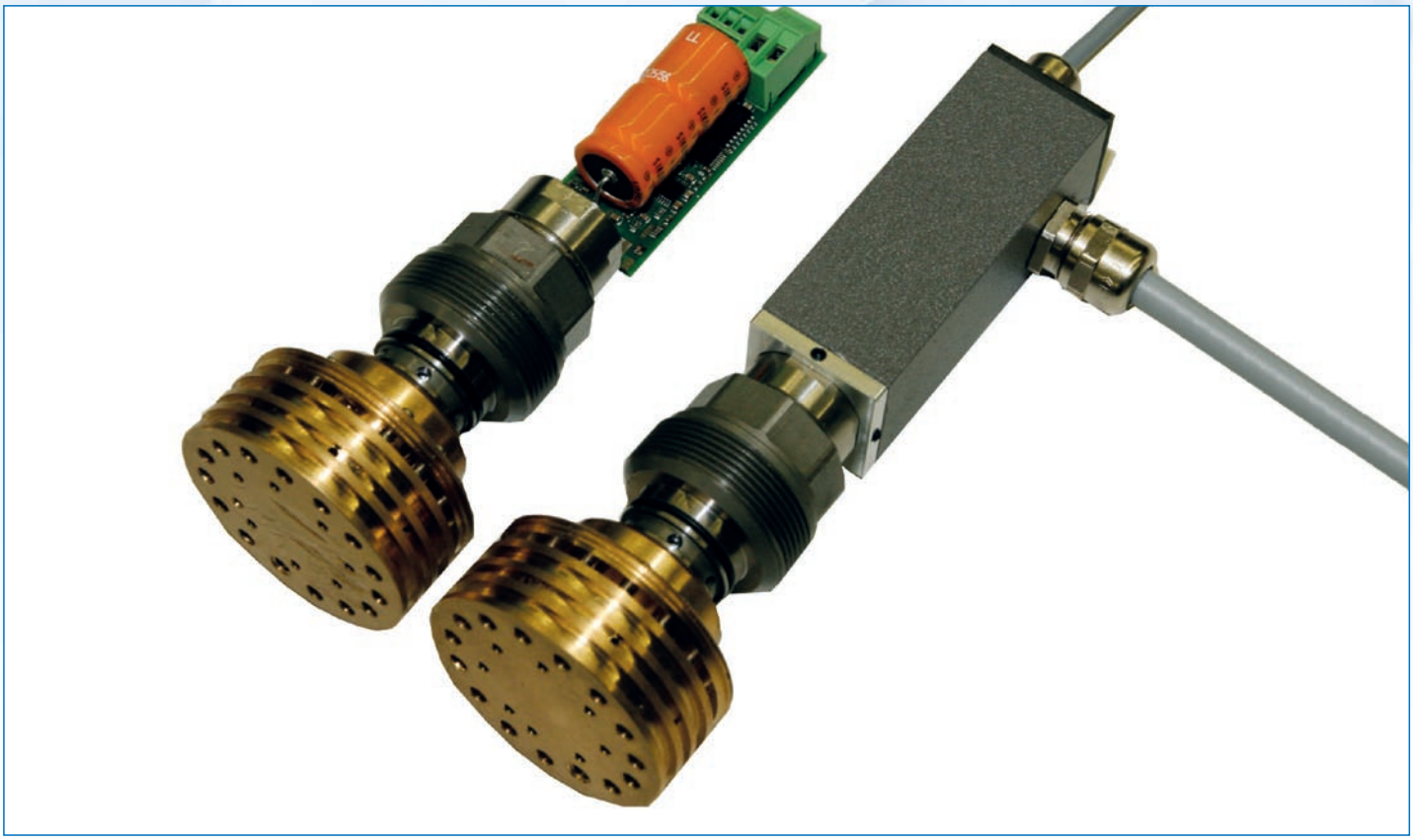

Fig. 1 Fast switching valve (~0.5ms) for big flow rates (~100l/min @ 5 bar)

Line of Business - Active Noise Control & Solutions

Yoel Naor, Silentium Ltd.

Silentium Ltd. is a high-tech company specializing in developing innovative active acoustic technology and in providing the production tools associated with it. It aims towards confronting the increasing noise pollution generated from a wide range of electric/electronic products. Silentium ANC utilizes unique cutting edge technology delivering up to 20dB(A) noise reduction across the entire audible spectrum and can be applied to versatile applications, such as server/networking equipment (IT), air treatment, and air conditioning machinery (HVAC) for the industrial, residential, automotive, as well as aviation markets, white goods, oven hoods, generator & car diesel engines, and more.

Silentium developed a generic controller for active acoustics and offers a range of tools for product developers and consultants to assist in applying active acoustics solution based on Silentium's S-Cube™ controller. Silentium proposes two alternatives for implementing the electronic controller:
(i)**S-Cube™** controller manufactured by Silentium,
(ii) **RDK** (Reference Design Kit), which is a set of instructions for adding the core components of the S-Cube™ to the customer's electronic board.
Silentium recently introduced a new innovation & its Silentium Expert Program (SEP) program:

Structural acoustics solution S-Barrier™

This ASAC technology is based on lightweight composite panels, equipped with piezoelectric actuators and a controller, producing counter vibrations superimposed with the structural vibrations, within the composite panel, to reduce the structure-borne noise.

Zone-to-Zone Complex sound field solutions:

Silentium is currently in the process of designing and developing a "smart" and robust system that can be positioned in an open space, for example:
a car or an aircraft, reducing the disturbing noise independently from the sources of noise and without interfering with the conversations in the room. Basically, this kind of system is capable of producing quiet bubbles around the spatial zone of interest, for instance, around car or aircraft seats. Examples of ANC based products with Silentium's active acoustics solution:

- Cray CX1 super computer incorporated Silentium's noise cancellation system to reduce fan noise.
- ActiveSilencer™ Enclosure (ASE™) for Intel® Modular Server: Silentium has collaborated with Intel® to design the enclosure for reducing the server noise by up to 10dB(A)
- ActiveSilencer™ duct – Ideally used for air- purifying, air-conditioning, furnace systems, oven hood, etc. to provide about 10dB(A) noise reduction.
- S-Fan™ – A 12dB(A) hot swap active silencer designed to be installed at the end of an axial fan & blower emitting or sucking air.

Silentium Expert Program (SEP):

Silentium established a new program to provide engineering companies and acoustic solution suppliers with the tools required for expanding their business opportunities by offering active acoustics solutions. Silentium experts will acquire the expertise to offer engineering support in the areas of ANC design, implementation and integration for OEM products & customized solutions. Silentium expert engineering team works closely with local field engineers to ensure OEM Partners success in developing and deploying their solutions based on products and technologies purchased from Silentium.

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Silentium Line of Business

New Member: isophon glas GmbH

Corporate Presentation, Torsten Bold

isophon glas GmbH was founded in 1979 and is a highly specialized manufacturer of glass systems with a current workforce of 70 people. The product range mainly consists of multi-layer glazing for windows and doors right through to edged, metal-coated or coated glass panels. ispohon products are used in building facades as well as shower cubicles in designer bathrooms. isophon glas GmbH's speciality is the fabrication of glass with special technologies as well as insulating glass panels in unusual shapes (with exotic geometry) and non-standard sizes.

As isophon traditionally is always seeking new challenges and new markets, innovation is a major part of the daily work. Insulated glass units (IGUs) are elements used in literally any construction project. Glass panels are combined with each other by means of one or several spacer units which result in an IGU that can have nearly any size and thickness. The glass panels themselves can be very different depending on the application. The thicknesses can vary as well as the glass can be single pane or consist of several laminated panels. Special insulating glass that is meant to prevent the discharge of thermal energy to a best possible extent has a special coating that blocks thermal energy to pass as well as the gap within the unit can be filled with special gases that insulate against thermal discharge even further. The gases used are usually Argon, Krypton or Xenon, which are filled into the window system after the assembly.

Special applications can require the insulated glass units to be attack resistant in terms of burglary or bullets. In these applications the glass units are assembled of panels consisting of laminated glass, special foils or wire mesh. Glass units that are to be especially sound retarding have special foils used for the laminated glass as well as a special gas filling. Sun resistant glazing has special coatings and special glas types used in the units.

As the above mentioned technology is applied as industry wide standard by all players of the market. isophons speciality is the assembly of insulated glass units with extraordinary dimensions and demanding constructions. isophon is a well known partner for special applications in insulated glass technology.

On the quest for new products beyond the standards mentioned above isophon developed a revolutionary system that allows the combination of glass and polycarbonate, a material unkown to the insulating glass industry until then. As glass is known to be hard and polycarbonate in comparison is known to be elastic and soft – the combination of these two materials was not feasible until then as the different thermomechanic characteristics resulted in an unbearable thermal stress. Insulating glass units with a traditional combination of these very different materials were therefore not available on the market.

isophons approach for the combination of glass and polycarbonate compensates the negative different material properties as well as it utilizes the positive characteristics resulting from the combination.
Without exposing uninteresting technical details one can say that the insulating glass unit remains assembled as usual and the polycarbonate panel is integrated within the assembly without any massive lamination or fastening. The results were more than stunning as the elastic polycarbonate added unforeseen functionality.

The integrated polycarbonate panel absorbs kinetic energy in terms of bullets or burglary attack to an extent unknown until then. Attack attempts in testing cycles conducted by isophon resulted in e.g. 200 blows with an axe without showing any form of penetration of the window system. Bullet resistance was tested with units consisting of several polycarbonate panels that resulted to be resistant against attack rifles with hardened core military projectiles. The insulation characteristics set new records compared with nearly any other glazing system on the market and assemblies designed for sound resistance surpassed all expectations as well. The product was introduced to the market as "trisophon" and the outstanding features were presented to the astonished customer audience in mid 2010.

All functionalities of trisophon mentioned above are still to be accompanied by further features of this market novelty as they are still to be exploited in research & deveoplement. First tests have shown that the polycarbonate panel for example absorbs laser beams as used in laser based audio surveillance systems. In combination with the bullet resistance trisophon seems to be an ideal choice for high risk facilities such as embassies or government buildings in terms of attack as well as espionage prevention. The trisophon with laser surveillance prevention is still subject to developments where the passive prevention of laser beam audio surveillance due to pure absorption is enhanced with an active piezo element that actively distorts any laser based espionage.

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isophon glas GmbH

isophon glas GmbH cutting tables

New Member:
Adaptronics International GmbH

Corporate Presentation, Dipl.-Ing. Harald Breitbach

The AI (Adaptronics International) GmbH has been founded on Nov. 18th 2009 with the headquarters in Hann. Münden and the R&D and strategy office in Buchholz, near Hamburg. The company is engaged in the technology field of adaptronics with a special focus on noise & vibration reduction, shape & configuration control as well as structural health monitoring & energy harvesting. Main goal of the company is concentrated on the serial production of adaptronic components for many technical branches such as aerospace, automotive, paper production machines, printing machines and production machinery, to mention just a few. In this context, AI is dedicated to provide the related market with all its capabilities starting from the analysis and identification of the corresponding physical problems, modelling and simulation, development of design concepts through to manufacturing and serial production. Along this technology chain AI´s activities are characterized by keeping very close contact with the customers in all phases of development contracts.

Mayor of Hann. Münden Klaus Burhenne, Harald and Elmar Breitbach and Jörg Bode, Minister for Economics, Labour and Transport, Lower Saxony (from left)

Adaptronic products are challenged by a great variety of both technical and commercial requirements such as maximum performance, minimum weight and space (light weight design), low cost, high durability, low energy consumption, easy inspections and repair conditions.

The high efficiency of AI is based on a team covering as completely as possible disciplines such as structural mechanics, structural dynamics, vibroacoustics, control technology, smart sensor and actuator concepts and their respective optimal interaction to each other in industrial serial products.

AI is part of a long-standing technology network in the European Center of Adaptive Systems e. V. (ECAS), located in Hann. Münden, consisting of users and developers of adaptronic systems as well as related research institutions and universities.

AI is on a successful way with a number of key contracts for companies active in fields such as printing machines, heat pumps, down-sized Diesel engines etc.

Last but not least it has to be mentioned that AI has full support from the Ministry for Economics, Labour and Transport, Lower Saxony (Niedersachsen).

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Textile technological integration of sensor modules in lightweight composite structures and possible applications

Holg Elsner, LSE - Lightweight Structures Engineering GmbH

The limited corporation Lightweight Structures Engineering (LSE) develops together with the Competence Center of Lightweight Structures (SLB) and the Chemnitz University of Technology (CUT) sensors for structure integration in polymer materials to increase the functionality and performance density of components in composite design.

The embroidered sensors can detect physical-technical quantities such as strain, capacity and temperature or fill levels in tanks, which can be measured with sensors of known technologies.

The benefits of the embroidery technology are especially the cost efficiency if large areas are fitted with sensors. Due to the embedding of embroidered sensors in complex composite structures components with additional functionality can be created which increases the use-value.

Embroidered sensor structures

Thin metallic wires or conductive coated or rather conductive yarn are used as sensor materials. Stitching techniques are used to attach the sensor material on a non-woven. Figure 1 shows a larger scale image of that. The wire shown in this picture is positioned by Tailored Fiber Placement technologies and fixed with clearly visible purple yarn on a non-woven polymer. In principle the shape and dimension can be designed individually. At the moment the achievable resolution is about 0.8 mm.

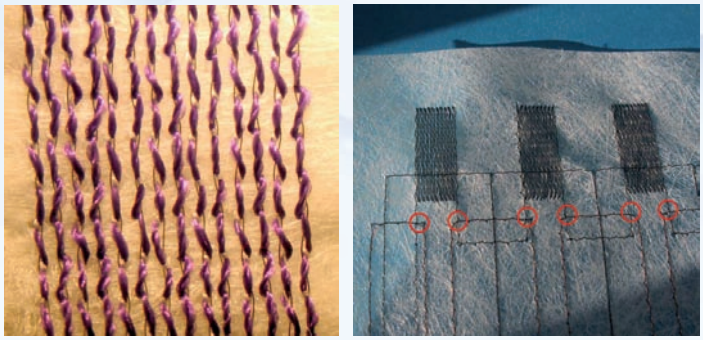

Fig. 1: Embroidered sensor structures

The sensor could operate on capacitive, inductive or resistive working principles. The chosen wire material depends on the purpose of the specific sensor or sensor array. For strain sensors (analogous to strain gauges) resistive wires of constantan are used. Inductive and capacitive sensors are made of copper wire. Conductive yarn or yarn coated with conductive materials can be processed as well. The typical diameter is from 40 µm up to 100 µm. Necessary diameters need to be chosen respective to sensor dimension and the required resistance. The usual use of chemicals to achieve required conductive geometry is not applicable. Sensor wires are soldered to contact pads after stitching. Further processes on other sensors depend on desired application. Signals can be transmitted wireless from inside of the part by integrating radio antennas and radio electronics.

Application as strain sensor

The total resistance is a very important parameter for strain sensors. Its value is key factor for power consumption by sensor system. Besides, typical resistances of 120Ω, 350Ω and 1kΩ per sensor can be designed for any value between and around that. Tolerance for series production is about ±10% at the moment. For small scale and laboratory application a tolerance of ±3% is achievable.

The demonstrated strain sensor has less priority in exact measurement of mechanical strains inside a component like common strain gauges. It is rather used to functionalize fiber reinforced structure
components. For example it is possible to adapt a part with a sensor that gives information about current status (health monitoring). Hence the sensor is embedded it is protected against environmental influence like humidity. By choosing an appropriate geometry and adjusting resistance the sensor can be freely customized and fitted to almost any component.

Through the combination of spring element and sensor to a functionalized structure component, the total amount of single elements in parts (e.g. gas pedal) can be reduced.

A common bridge connection is used to analyze the sensor signal in the same way as for typical strain gauges. If a standard value is chosen for resistance a usual industrial analysis unit can be applied.

A k-value of 1.93 was determined as transmission parameter. If the signal of the embroidered sensor is compared with a signal of a regular strain gauge beam arrangement no significant difference can be determined. (Figure 2 and 3)

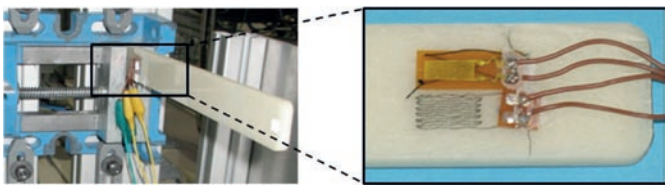

Fig. 2: Beam arrangement to compare embroidered sensor with regular strain gauge

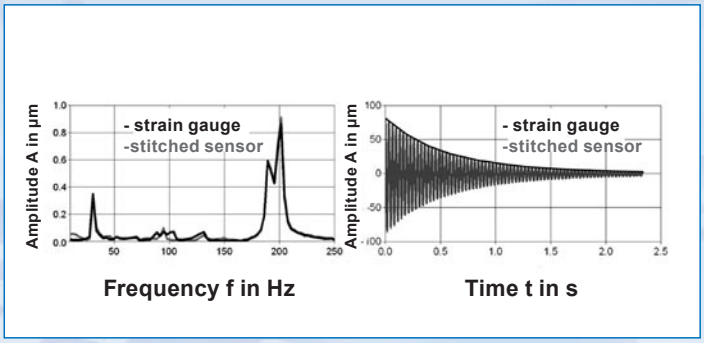

Fig. 3: Comparison of stitched sensor signal with strain gauge signal

Application as fill level sensor

Capacitive sensors are applied to measure fill levels in tanks. Working principles and measuring methods of that kind of sensors are well known. One possible method is detecting changes in the electric field. Hence, the medium to be measured must be at least weakly conductive. With that method limits can be detected or fill levels can be measured continuously. Two electrodes are required and needed to be placed as close as possible to the liquid. For thick walled containers this can be a real challenge. To get a stronger signal it is better to place it as close to the medium (liquid) as possible. Using those sensors, it is possible to position them anywhere within the wall thickness. The total thickness of the wall is nearly unimportant (compare Figure 4). Due to the sensors thickness of about 200µm they are very suitable for thin walls as well. The non-woven with sensor geometry embroidered is incorporated in thermosetting resin. Therefore the sensor becomes part of the support structure of the polymer matrix. So it is not creating a separate layer which is leading to structural weakness. The same applies to embedding into thermoplastic materials.

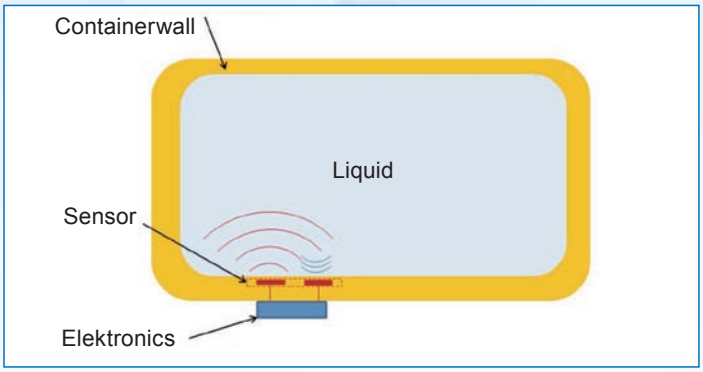

Fig. 4: Functional principle of a capacitive fill level measurement system

Other authors of different publications name some possibilities to integrate sensors into container wall, but this has never been realized in a real application. Apparently suitable production technologies or integration methods and proper sensors are missing.

Because of small installation height the embroidered sensor is quasi-two-dimensional shaped. Therefore they can be integrated into tank wall or applied outside. Due to embroider technology shape and size of these sensors can be designed freely. Hence small and larger series can be produced economically. Because of embedding the sensor inside polymer matrix the medium (liquid) cannot touch sensible wire construction. At the same time the sensor is protected against mechanical damage, corrosion and dirt during whole product life cycle. Additionally the sensor cannot be damaged while cleaning the container. The wall itself is sensor case. The tank remains form-fitted and still has the same structural stability as without sensor.

The sensor can be fitted to arced or buckled surfaces. The used thermosetting or thermo plastics must not be conductive. Improved productions methods for structure integration into polymers are a real innovation. Novel sensitized tanks with new functions can be created. Additional mounting and adjustment processes are no longer necessary.

The basic capacity is about 100 pF. For water as liquid medium change in capacity could be about 30% to 50%. The water level can be measured analogue and gapless.

Application as humidity sensor

Capacitive and resistive measurement setups are known techniques to measure humidity inside materials. For the first time economic measurements of humidity directly inside a material are possible using the embroidered and structure integrated sensor system developed by Competence Centre for Lightweight Structures.

Through the embedding of stitched sensor systems in mineral construction materials (e.g. masonry, concrete, plaster, etc.) as lost sensors permanent measurements can be taken in defined periods of time. That cannot be realized with any other existing measurement technique. Stable Measurements can be taken any time, even after many years. In case of renovation works leak detection or wet areas can be localized easily. Therefore actions of quality control and quality assurance can be significantly improved.

Based on own research activities it can be shown that capacitive measurement methods give better result in mineral construction materials. Thereby the measurement principle is similar to DNS method in building industry with the advantage of performing measurements directly inside the structure. Comparisons between stitched structure integrated humidity sensors and general accepted laboratory methods according to Darr-principle show sufficient matches.

Application as Temperature Sensor

Temperature sensors can be made in two working principles. First the sensor can be designed like a thermocouple. Therefore two different wire materials are an embroidered on a web. On a junction between two wires the different metals produces a voltage related to a temperature difference. An electronic circuit can covert the voltage change into a temperature signal. This method is ideal for

measuring single spots. An application could be to measure the core temperature of a heated composite mould.

On the other hand the sensors can be designed in the same way as strain sensors. Due to a high temperature coefficient nickel is chosen as an appropriate wire material. The change in resistance is related to the change in temperature. An electronic circuit is used to convert the changes into a voltage or current. The sensor can be designed to cover large or small measurement areas.

We are using a nickel wire to measure the temperature. The wire is place in the meander pattern on a fibrous web. The size of the sensor depends on the desired resistance at room ambient temperature. And the resistance is based on the diameter and the length of the wire. A higher resistance leads to a higher sensibility and better accuracy and to larger temperature ranges as well.

That kind of embroidered temperature sensor is a distributed sensor. The measured temperature is the average temperature in the sensors area. Currently the smallest sensor is about 35 x 35 mm. A smaller sensor could be developed if necessary. However, sometimes it is better to measure the average temperature of a small area instead measure a single spot. Lager areas can be covert easily by increasing the distance between the wires of the meander structure.

Conclusion

Embroidered sensor systems have huge potential of innovation. The high degree of design freedom with conductive wires allows individual solutions where standard sensors cannot be applied. Size, shape and output signal of sensors can be adjusted as desired. If sensor geometry is placed in pattern, a high flexible functional sensor system can be created. Depending on sensor applications and required properties different conductive materials and diameters can be used. Due to their small thickness of about 200µm and limp base material embroidered sensors can be embedded into fibre reinforced plastics. This sensor becomes just another layer and does not affect the structures stability at all. The embedding protects the sensor against environmental influence of any kind because the component is casing the sensor at the same time. This technology can be applied to thermo or thermosetting polymers and others like mineral building materials. Components can be functionalized with positive affects to the value chain. Additional mounting and adjusting steps of those sensors can be omitted. The sensors can be applied in different ways. They can detect intern status of structures like stress or health monitoring or they can measure external properties like temperature or fill levels. Stitching is a very customizable technology which allows a wide range from small to large scale production.

All these facts show the potential of this technology. Though, more research needs to be done. Not all side effects are understood yet. There are no design rules or standards for embroidered sensors. Any sensor needs to be designed individually. There is no out-of-box solution for standard applications yet. For industrial applications reliability and production methods needs to be improved as well.

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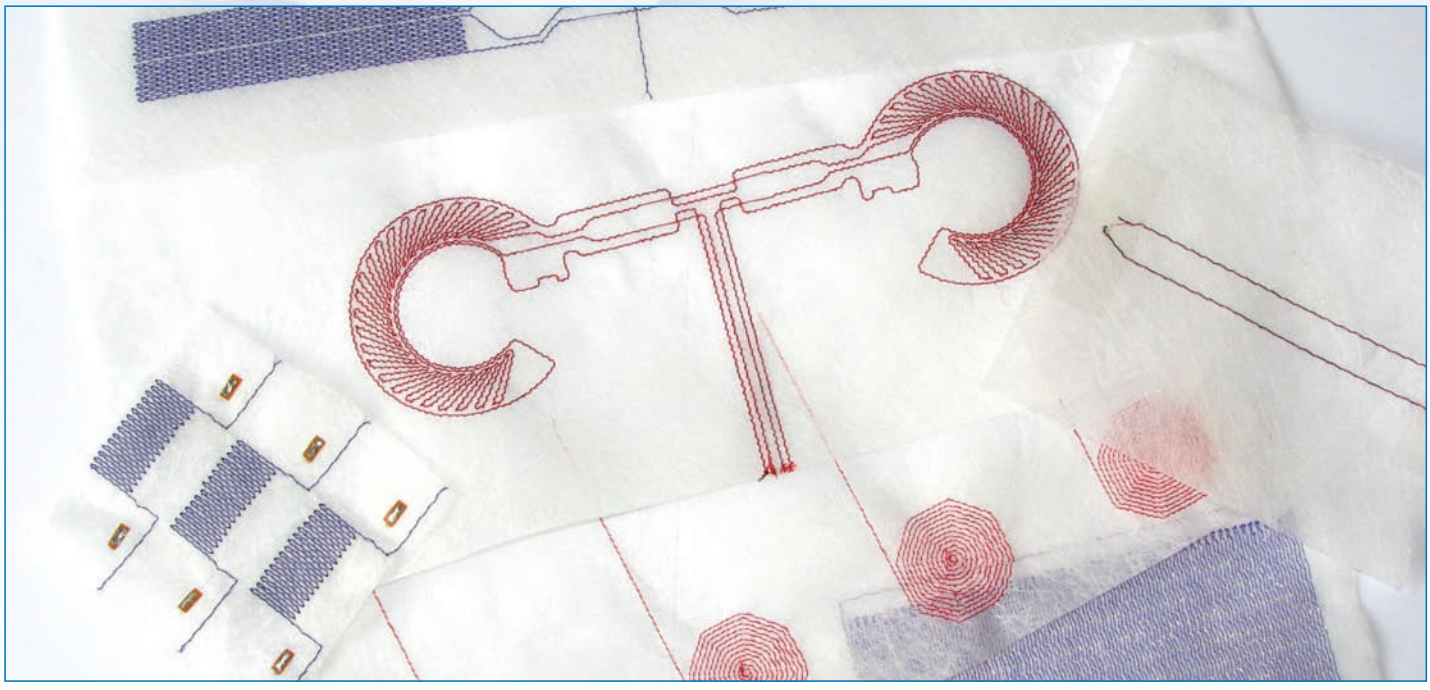

Fig. 5: Several embroidery designs

GATEngineering is an emerging company using flat hierarchies to get fast decisions. Our experience goes from developing lightweight composite components to process and production consulting of innovative solutions in product manufacturing.

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email: b.steinbrecher@gat-e.de

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For our office in Braunschweig / Germany we are currently searching for highly motivated

Electrical engineering trainers

Good knowledge of vehicle engineering/electric vehicles required.

The electric vehicles department requires all staff working in the development process, from the initial prototypes through to mass production, to have in-depth knowledge of high-voltage batteries

YOUR TASKS WILL BE:

- Train employees at the GATE training facilities and on site with clients
- Produce and revising training material
- Determine content for examinations and developing exam papers

If you would like to join our dynamic team, please don´t hesitate to contact us!

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Required immediately to join our electronics team in **Braunschweig** in the development of battery and power electronics for electrically powered cars

Design engineer / Electrical engineer / Development engineer

Good knowledge of aircraft or vehicle engineering and experience with SIMULINK and MATLAB required.

For ambitious developers with vision we can offer further training opportunities in adaptronics.

YOUR TASKS WILL BE:

- Create software architecture in the field of electric vehicle development
- Create simulations and modelling using MATLAB and SIMULINK

If you would like to join our dynamic team, please don´t hesitate to contact us!

Please send your application documents, stating your preferred entry date, to:

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Piezo INSTITUTE

The European Institute of Piezoelectric Materials and Devices

The Piezo Institute, a new European organisation dedicated to research and application development in piezoelectric materials and devices, was launched in Summer 2007. Emerging from EC-funded projects such as MIND and POLECER, the founding members represent some of the best academic and industrial expertise in this fast-growing sector. The Piezo Institute is the European hub of expertise and resources in piezo technologies, offering research, resources, education and training. Its expertise includes ferroelectricity, electrostriction, pyroelectricity, piezoelectricity and multiferroicity in materials including ceramics, single crystals, polymers and composites. “The science of piezoelectricity has been known for more than a century,” notes Wanda Wolny, a founding member and MD of piezo ceramics manufacturer Ferroperm in Denmark. “The institute is Europe’s recognition that there is now far greater potential for piezo applications in healthcare, transport, energy harvesting and environmental protection. It will help us to keep up with the rapid pace of piezo development in Asia and North America.” The institute’s executive board and founding members includes researchers from the UK, France, Germany, Italy, Switzerland, Slovenia, Spain and Latvia. Companies involved include Fiat, Siemens and Meggitt. The institute offers research and consultancy in chemistry and process engineering, solid-state physics, materials characterisation, metrology, standards and the manufacture and testing of piezo devices. It has created the first Pan-European Masters Programme in piezoelectricity.
For more information about joining the Institute please go to www.piezoinstitute.com

PIEZO 2011 - www.piezo2011.com

Electroceramics for End-users VI is the next scientific event in the series of conferences dedicated to advances in electroactive, particularly piezoceramic, materials and devices.

It was established by the POLECER Thematic network and continued by the MIND Network of Excellence, starting in Interlaken, Switzerland, 2002.

This is the sixth conference Electroceramics for End-users, and the second organised by the Piezo Institute. Piezo 2011 will continue the conference’s established traditions of presenting the latest piezoelectric materials and devices research; and bringing together the international community for discussion and networking.

Following the tradition of Piezo conferences, the Piezo 2011 conference will be organized in Sestriere (northern Italy), the location of Turin’s 2006 Winter Olympic Games.
There will be seven technical sessions, each with an invited keynote presentation.

Topics that will be explored at the conference include:

- Energy,
- Environment (Lead-free, Processing, Enhanced performance),
- Security (Sensing, Resources),
- Flexible substrates,
- Food processing technologies,
- Avionics,
- Telecommunications/ materials for ICT,
- Multiferroics,

INVITED SPEAKERS

Roger Whatmore, Tyndall National Institute, Ireland
Christophe Paget, Airbus, France
Zhong Lin Wang, Georgia Institute of Technology, USA
Carsten Schuh, Siemens, Germany
Tadashi Shiosaki, Shibaura Institute of Technology, Japan
Tadashi Takenaka, Tokyo University of Science, Japan

TUTORIALS

There will also be tutorials led by international experts. These courses will provide unique insights for early stage researchers and those interested in broadening their skills.

Piezo 2011 - Electroceramics for Endusers VI

PRICES

	Piezo Institute members €	Non members €	Students €
Early registration (until 15th January 2011)	550	650 (incl. 1 year membership of PI)	200 (excl.conference dinner*)
Regular registration	600	700 (incl. 1 years PI membership)	250 (excl. conference dinner*)
Spouses (incl. conference dinner*)	150	175	

*Conference dinner € 50

VENUE

Sestriere town rises up to 2035 metres altitude and links the Chisone and Susa valleys in Piedmont, only a few kilometres from France.

It is at the heart of the extensive Vialattea ski area that offers skiers the possibility to link to five other ski resorts making a total of 400 km of slopes, many of them are artificially snowed and with ski-lifts and chair lifts for disabled.

More information can be found on **www.comune.sestriere.to.it/default_e.asp**

HOTEL

The hotel is the Ròseo Hotel Sestriere:

www.roseohotelsestriere.com

Hotel prices (rooms) from €100 per night.

Ròseo Hotels Sestriere will offer special room prices to the participants wishing to extend the stay beyond the conference period.

Please keep checking the conference website for updates

CONTACT

Piezo 2011 Secretariat

Konstantin Astafiev – The Piezo Institute - **www.piezoinstitute.com**

E-Mail: **konstantin.astafiev@piezoinstitute.com**
Tel. **+45 49 12 71 21**

IMPORTANT DATES

1st November 2010: **Abstract submission deadline**

15th November 2010: **Notification of acceptance**

15th January 2011: **Early registration deadline**

The abstracts should be sent directly to the Scientific Coordinator of the conference Dr. Robert Dorey, Cranfield University, UK, at
robert.dorey@piezoinstitute.com

Please see **www.piezo2011.com** for full submission details

GENERAL CHAIRS

Alessandro Zanella – Centro Ricerche FIAT, Italy

Robert Dorey, Cranfield University, UK

PIEZO 2011

Electroceramics for End-users VI is the next scientific event in the series of conferences dedicated to advances in electroactive, particularly piezoceramic, materials and devices.

It was established by the POLECER Thematic network and continued by the MIND Network of Excellence, starting in Interlaken, Switzerland, 2002. The following conferences were:

Following the tradition of these conferences, the Piezo 2011 conference will be
- **Courmayeur**, Italy, 2004
- **Hafjell**, Norway, 2006
- **Liberec**, Czech Republic, 2007
- **Zakopane**, Poland, 2009

organized in Sestriere (northern Italy), the location of Turin's 2006 Winter Olympic Games. This event is organized in cooperation with ATA Associazione Tecnica dell'Automobile

This is the sixth conference Electroceramics for End-users, and the second organised by the Piezo Institute. Piezo 2011 will continue the conference's established traditions of presenting the latest piezoelectric materials and devices research; and bringing together the international community for discussion and networking.

There will be seven technical sessions, each with an invited keynote presentation. There will also be tutorials led by international experts. These courses will provide unique insights for early stage researchers and those interested in broadening their skills.

TUTORIALS

Introduction to piezoelectric materials and devices: **Markys Cain**, NPL

Processing and structural characterization of lead-based and lead-free piezoelectric ceramics: **Marija Kosec**, Jožef Stefan Institute

Energy harvesting, principles and technologies or Piezo MEMS: TBC

CONFERENCE TOPICS

There will be seven technical sessions, each with an invited keynote presentation, and topics that will be explored at the conference include:

- Environment
  - > Lead-free
  - > Processing
  - > Enhanced performance
- Materials for ICT
- Multiferroics
- Flexible substrates
- Energy harvesting
- Security
- Structural Health Monitoring
- Food processing technologies
- Avionics
- Health
- Telecommunications

We aim to provide full peer reviewed submission to the Journal 'Advances in Applied Ceramics'.

INVITED SPEAKERS

Roger Whatmore	Tyndall National Institute, Ireland	Aurivillius Phase Materials: New room temperature multi-ferroics
Christophe Paget	Airbus	Piezoceramics in aircraft maintenance
Zhong Lin Wang	Georgia Institute of Technology	Piezotronics and Nanogenerators
Carsten Schuh	Siemans	Lead free applications
Tadashi Shiosaki	Shibaura Institute of Technology, Japan	Piezocomposite Comprising Piezoelectric Single Crystal and Porous Polymer Resin / Electrical Properties in (Li,Na)NbO3 Ceramics after Poling Treatment
Tadashi Takenaka	Tokyo University of Science, Japan.	Lead-free Piezoelectric Ceramics based on Perovskites and BLSFs
Andy Bell	Leeds University, UK	Bismuth ferrite materials
Steve Beeby	Southampton University, UK	Energy Harvesters on textiles

LOCAL ORGANISING COMMITTEE

Marisa Giunipero - ATA Associazione Tecnica dell'Automobile, Italy

Alessandro Zanella – Centro Ricerche FIAT, Italy

www.piezo2011.com

Piezo INSTITUTE

Members of ECAS e. V.

Status: November 2010

Research and Development

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft
- CNT, ASAC, mass damper
- Adaptronic aeronautic-structures

DIK
- Elastomer and material development
- Nano composite materials

Fraunhofer LBF Institut Betriebsfestigkeit Systemzuverlässigkeit
- System reliability
- Noise & vibration reduction

Leibniz Universität Hannover
- Machine tools
- Production engineering
- Manufacturing processes

HAWK HAWK Hochschule für Angewandte Wissenschaft und Kunst — Fachhochschule Hildesheim/Holzminden/Göttingen — University of Applied Sciences and Arts
- Optics
- Oscillation reduction in machines

LCM LINZ CENTER OF MECHATRONICS GMBH
- Active oscillation reduction
- Magnetic bearing technology
- Hydraulics

PFH Private University of Applied Sciences
- Management of the master degree course “Adaptronics”

Technische Universität Carolo-Wilhelmina zu Braunschweig
- Adaptronics in machine tools
- Parallel structures
- Process monitoring

TU Clausthal Clausthal University of Technology
- Software
- Systems
- Engineering

LLB
- Adaptive structures
- Fibre compound structures
- Membranes / reflectors

University of Twente The Netherlands
- Control engineering for noise and vibration reduction
- Development of algorithms

KIT Karlsruhe Institute of Technology — wbk Institut für Produktionstechnik
- Adaptive struts
- Simulation
- Machinery concepts

Small and medium-

A2 Acoustics
- Noise & vibration reduction
- Antinoise

adaptronics international ai
- Noise Reduction & Vibration Control
- Development & Production of Adaptive Solutions

bec breitbach | engineering | consulting
- Development and planning of adaptive systems

EEW Maschinenbau GmbH
- 5-axis CNC machines
- CFRP-support structures

GATE German Advanced Technology Engineering
- Aircraft & autom. construction
- Construction & Development of lightweight components

INVENT
- Production of CFRP parts
- Production of Piezo-actuators

PASO
- High precision engraving machines

Wölfel Beratende Ingenieure
- Dynamics of machines
- Automotive engineering

sized businesses (SME)

- Management of the Adaptronic Congress

- Robotics
- Production engineering

- CFRP for structures
- Process optimisation

- Development of adaptive system solutions
- Measurement engineering

- Security Technologies
- Security Solutions

- Production of Shatterproof & Tap-proof glasses

- Development and production of controlling circuits
- Antinoise-modules (S-Cube)

Industry

- Active noise control
- Vibration control
- Actuators / Sensors / Control

- Measurement technology for surfaces and shapes
- Optical measurement

- Prosthetics / Orthetics
- Functional lightweight design

- Machine building for rail, road, industry and navy

With support of the members

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