KD Info

1st Edition 2017

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Save the Date: KARL DEUTSCH NDT-Symposium 2017

This September will be a special one. On September 11th and 12th our customers will have the chance to visit us and experience current instrument developments. Many technical lectures will be given (in German language). Also, all our test instruments will be on display and can be checked out with the help of our experienced staff. Customer-specific applications can also be discussed. Although this event is focused on our German-speaking customers, international guests are of course more than welcome.

The programme of the NDT Symposium in brief:

Monday, September 11th (day 1)
Ultrasonic Testing Systems, Magnetic Particle and Penetrant Testing, Trip with the Wuppertal Skytrain and Dinner

Tuesday, September 12th (day 2)
Test Gauges, UT Flaw Detectors, Phased Array Portables

A detailed programme is available in German language on our website.

A similar event in 2015 drew approximately 200 guests which took the chance to visit us, gain practical experience and see products, applications and our production facilities.

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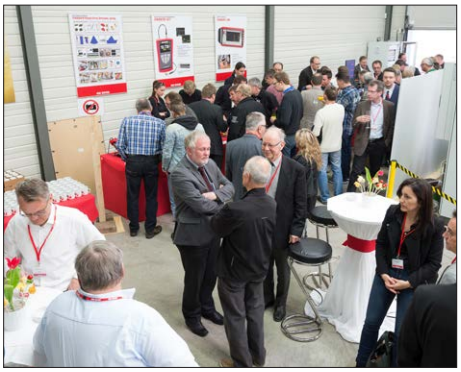
Touch and try: A snapshot of the Open House in 2015

KARL DEUTSCH

Continued from page 2

Besides receiving hands-on advice and demonstrations, all product groups of KARL DEUTSCH are presented: portable test instruments, ultrasonic testing systems, sensors and MT/PT test liquids for surface crack detection. We are looking forward to receive many guests and surely can help with the hotel accommodation. **Hs**



KARL DEUTSCH International Sales Meeting

Our international sales partners will meet in Wuppertal from September 13th to 15th. All participants will get an overview about the current portable test instruments, testing systems and new developments. We are looking forward to this event!

The programme of the Sales Meeting in brief:
Wednesday, September 13th (day 1)
Presentation of UT, MT and PT testing systems. Presentation of MT and PT test liquids. Dinner at the historic concert hall in Wuppertal at 7 pm.
Thursday, September 14th (day 2)
Presentation of portable test instruments. Boat trip on the Rhine river with dinner at 7 pm.
Friday, September 15th (day 3)
Training session for portable test instruments. KD summer party starts at noon.
Saturday, September 16th (day 4)
Sight-seeing tour around Wuppertal

Participants of the last International Sales Meeting in September 2013

Product presentations, NDT applications and instrument training: Also this year, it will be an interesting mix of theory and practical experience.

ECHOMETER 1076 TC: New Transducer for Hot Surfaces

Measuring the wall thickness on hot surfaces is always difficult, since the oscillator material in the transducer is sensitive to high temperatures. In extreme cases, this may result in the complete failure of the transducer.

Even though the oscillator element of a wall thickness transducer generally is mechanically protected by a delay line of some millimetres length, however, due to the lack of sufficient heat insulation properties of the delay line it is not protected to heat induced damage.

Furthermore, in regular delay line materials the temperature effects are too large to ensure stable measurements. Materials with a low heat conductivity typically have high sound attenuation properties, thus they are not suitable.

The new wall thickness transducer DSE 8.3/15 PB 5 HT from KARL DEUTSCH comprises a delay line made of special plastics. This material combines essential properties for this application, like a high heat insulation, low sound attenuation and small temperature effects. The transducer can be used with the ECHOMETER 1076 TC and copes easily temperatures of 150 °C, even with prolonged contact.

Special transducer with heat resistant delay line

In a measuring range of 2 mm to 25 mm (at a sound velocity of 5920 m/s) the wall thickness can be measured stable and reproducible. This, for examples, permits to use the probe in all cases where the residual wall thickness of pipes containing hot media needs to be determined without shutting down operation. **Ki**

Wall thickness gauging at a surface temperature of 135 °C

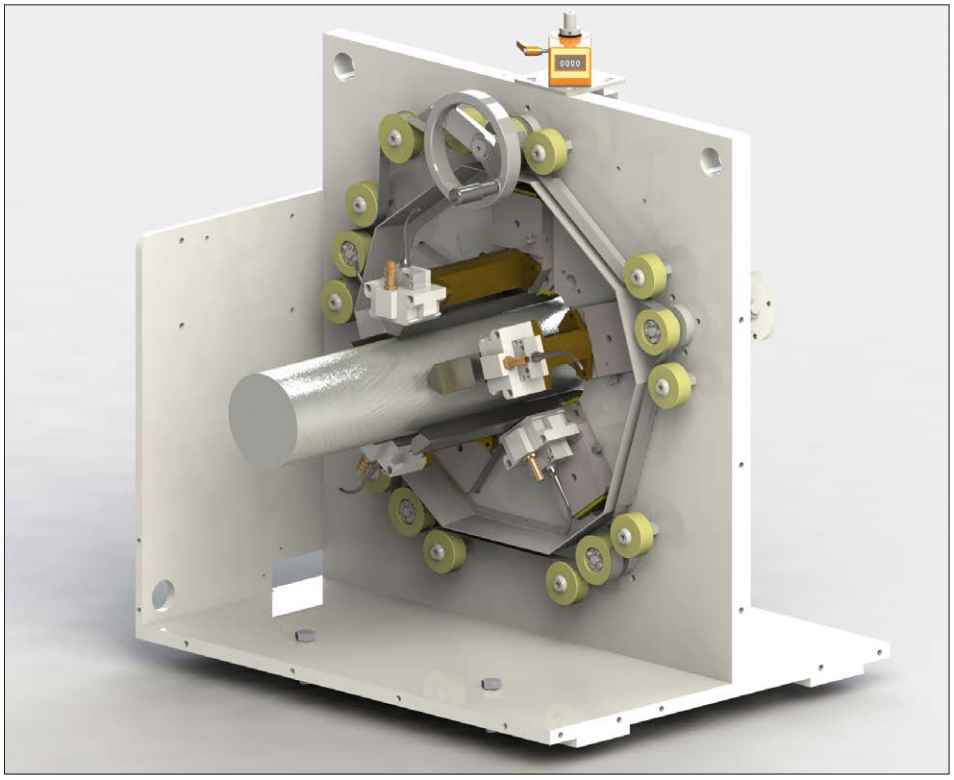
www.karldeutsch.de » Products » Wall Thickness Gauges » Gauges » ECHOMETER 1076 TC

ECHOGRAPH-STPS-PAUT: Phased Array Bar Testing

The concept of the ECHOGRAPH-STPS testing system has been well-proven for decades. The system is available in various mechanical sizes in order to cover a large diameter range. So far, projects within the diameter range from 10 mm to 150 mm have been implemented. Normally, round bars are to be tested. Special test mechanics for flat and rectangular profiles have also been developed.

Advantages of the testing systems are:

- High test speed (linear bar feeding with 1 to 2 m/s)
- Robust and simple test mechanics
- Fast change-over for a different diameter (common toothed belt drives for all probe holders, adjustment by hand-wheel or by motor)
- Spring-loaded suspension of the probe holders (for perfect compensation of bar straightness tolerances)
- Contact-free ultrasonic coupling with water nozzles (and therefore little probe wear, also in case of black bar testing)



CAD-drawing of a test mechanics with five phased array probes shown for a bar diameter of 130 mm

The ECHOGRAPH-STPS testing systems normally contain 9 or 15 probes which already provide a good coverage of the bar cross section. By using the phased array technique, the num-

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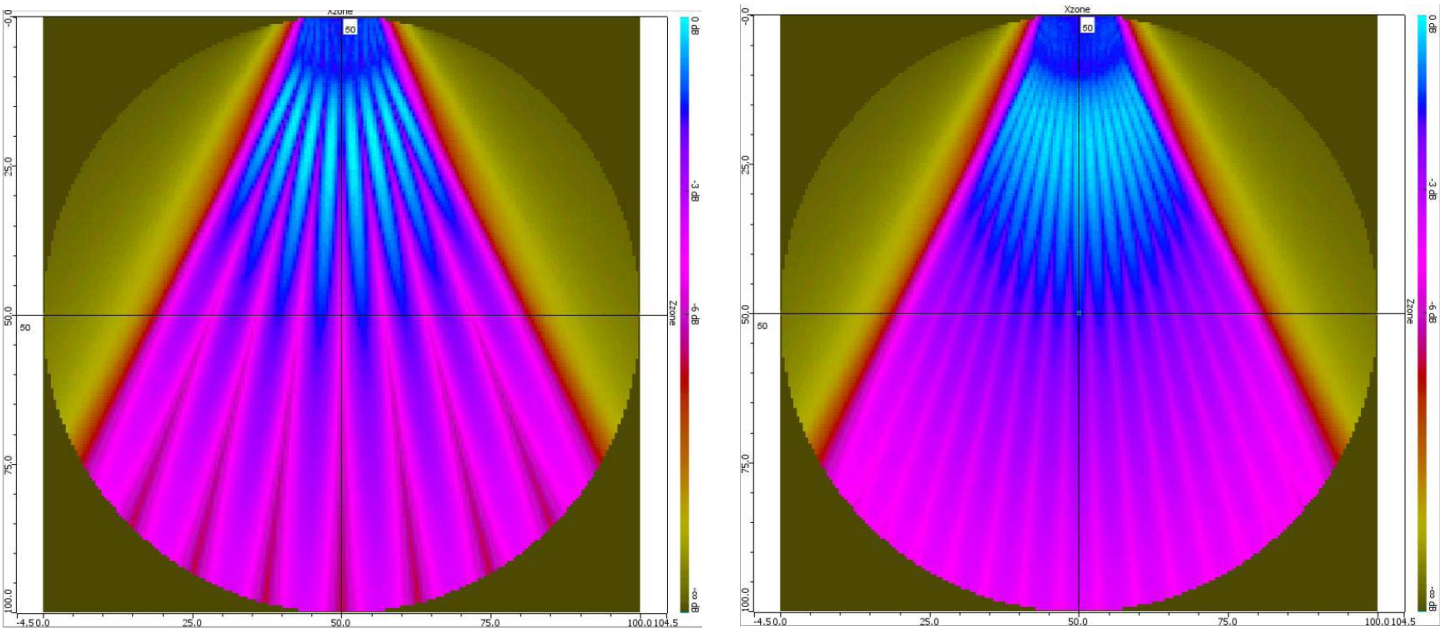


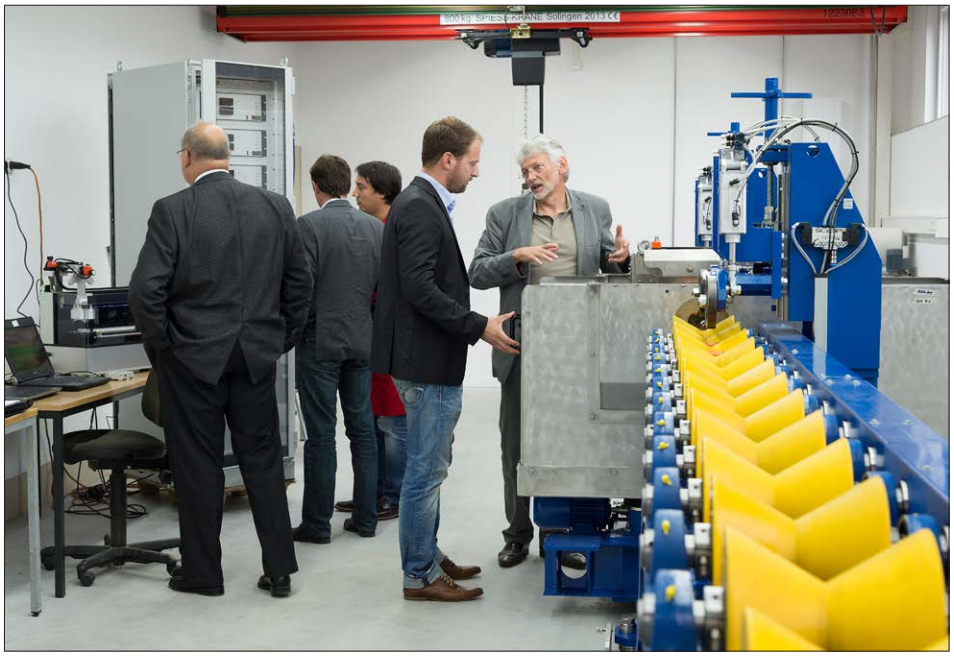
CIVA simulation for a sector scan with one of the five array probes: 8 shots (left) and 15 shots (right)

Continued from page 4

ber of ultrasonic shots is increased and full cross-sectional coverage is achieved. Five phased array probes produce sector scans with up to 20 shots. In total, up to 125 parallel test channels are active.

Successful onsite field trials at a plant of a KARL DEUTSCH customer were carried out. The existing test mechanics was provisionally modified. Now, a full testing system was manufactured at KARL DEUTSCH and is put into operation in our UT systems laboratory where a roller conveyor of the SEMA company is available.

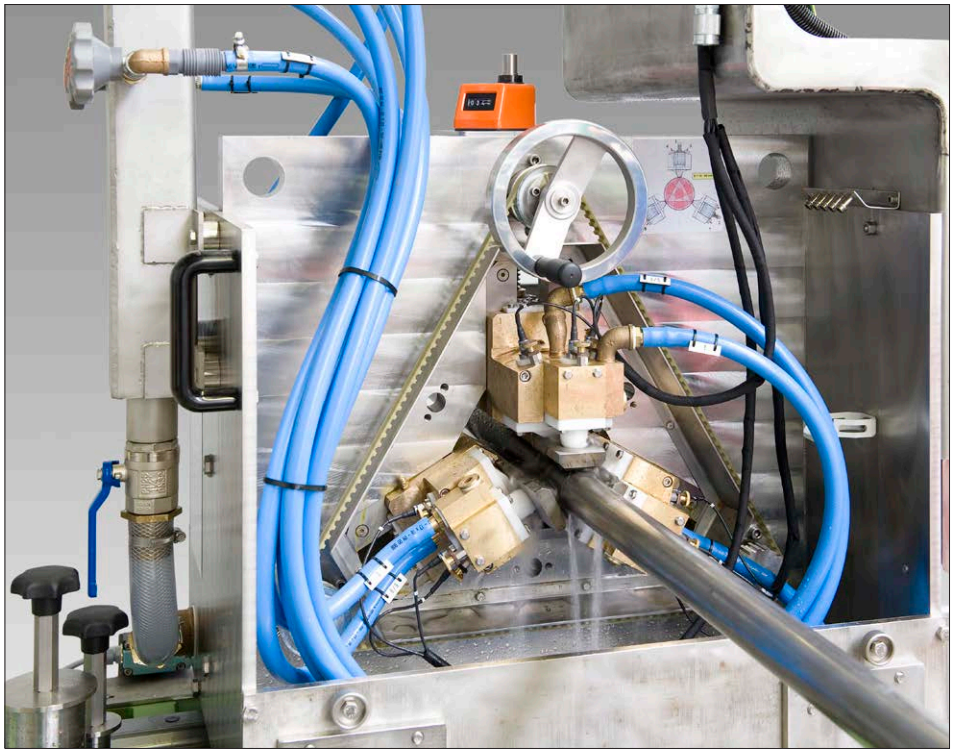
The lab conveyor allows for trials in dynamic mode with realistic testing speeds. Several reference bars of varying diameter are available. They contain artificial defects which were produced and certified by the BAM institute for material research and testing in Berlin, Germany.



Testing laboratory for ultrasonic testing systems with roller conveyor for dynamic trials – also on material provided by customers!

While bright bars are often tested with a full ring of array probes and more than 500 test channels (compare our ECHOGRAPH-HRPS testing system), another testing concept is now presented which offers many advantages for black bars with rough surfaces and larger straightness tolerances. The reduced effort for the test electronic and the sensors and little probe wear yield a service-friendly test operation.

You are welcome to visit our Works 2 for trials! **WD**



ECHOGRAPH-STPS testing system for bar testing with nine probes

Product videos on our Youtube channel “NDTChannel”

www.karldeutsch.de » Products » Ultrasonic Testing Systems

GEKKO: Phased Array Technology for the Survey of Friction Welding Processes

In the year 2016 a joint research project was carried out by the *iwb* Institute for Machine Tools and Industrial Management of the Technical University in Munich and the company KARL DEUTSCH Pruef- und Messgeraetebau GmbH + Co KG. The subject of this project was the online survey of a rotation friction welding process with ultrasonic phased array techniques. This article presents the main results.

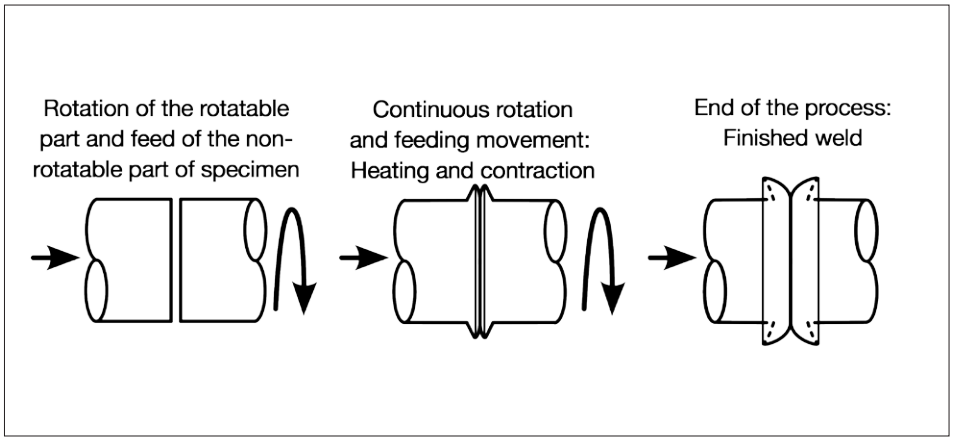


Fig. 1: Principal process sequences of rotation friction welding

By installing a phased array probe in a rotary friction welding system, the faces of the components can already be tested with ultrasound during the joining process. Based on the measuring results, it is possible to gain significant knowledge about the sequence of the welding, which then can be used for process monitoring.

Rotary friction welding is a joining process that is used in the production of a variety of components. The advantages of the process are that even materials not suitable for fusion welding can be combined with high quality, and combinations of various metals are possible. The method is based on the friction between the contact faces which in most cases are rotationally symmetric.

First of all, one of the components is set into a rotary motion. Subsequently, the components are pressed together by applying axial force. As a result, the material in the area of the joining surfaces is heated and softened so that it is laterally pressed out resulting in a joint (see fig. 1).

In order to expand the possibilities for monitoring of the process, examinations were carried out in cooperation between the Institute for Machine Tools and Industrial Management (*iwb*) of the TU Munich and KARL DEUTSCH.

For the examinations a phased array probe (manufacturer: KARL DEUTSCH)

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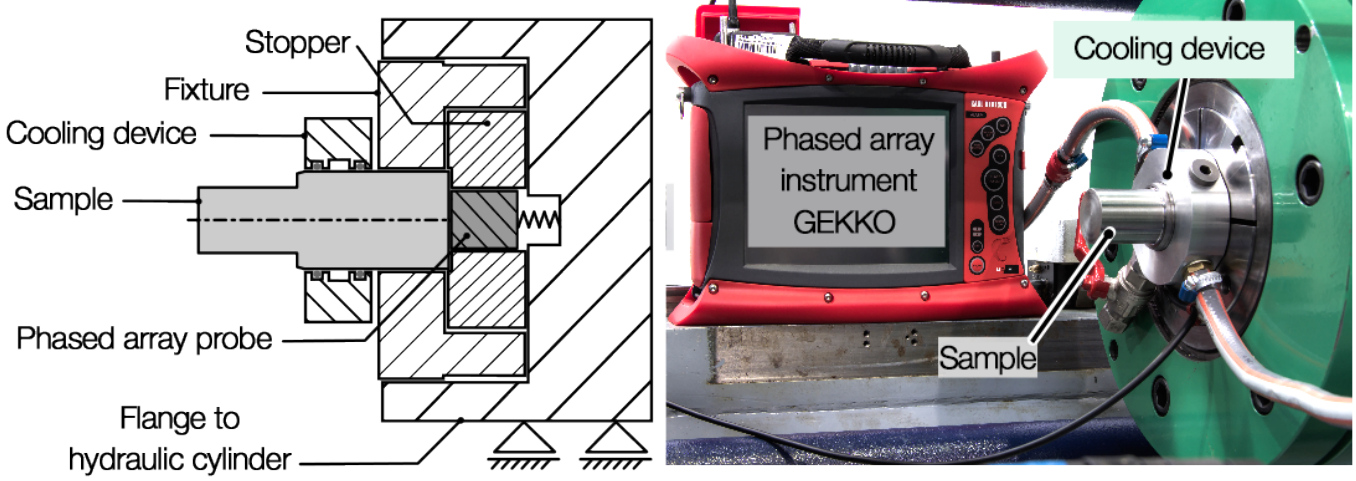

Fig. 2: Drawing and photo of the setup with the statically mounted part of the sample before the welding process

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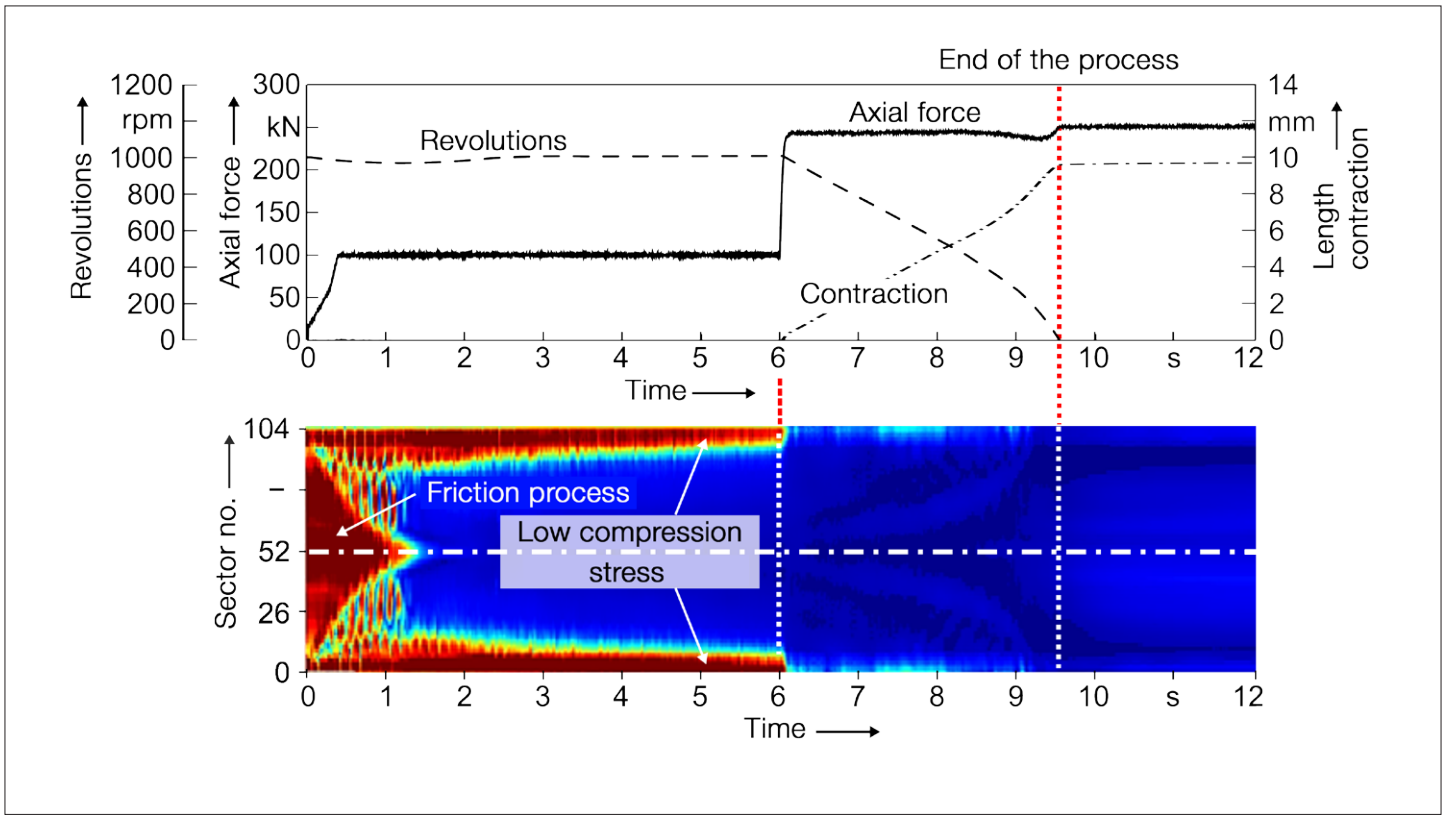

Fig. 3: Time diagram of the friction welding process (top) and time-based phased array amplitudes out of the weld

was integrated into the mechanical fixture of the rotation friction system of the *iwb*. This enables ultrasonic insonification into the static part of the sample already during the welding process, see fig. 2.

A linear array with 64 elements was applied in combination with the portable phased array instrument GEKKO. Due to the well-designed graphical user interface of the GEKKO it was possible to create an interface between the system control and the GEKKO instrument. This enabled remote start and stop of the measurements and to record the results synchronously with the system control.

The material of the samples to be welded was a heat-treated steel 42CrMo4 with a diameter of 50 mm in the fixation region and 40 mm across the welding faces.

For the measurements, the use of a phased array probe paid off in several ways.

On the one hand, the geometry of the sound field could be selected in such a way that no interfering reflections were generated at the shoulder to the reduced diameter. In addition, it was found that the representation of the ultrasonic response over the process time allowed numerous conclusions regarding the process sequence, since both time- and location-dependent effects could be observed by the two-dimensional visualization.

It can be seen in fig. 3 that the weld faces strongly reflect the sound at the start of the process (red colour). In the further course of welding, however, the inner region becomes more and more permeable, until after about 1.3 s, the propagation of the sound waves in the core region is only slightly impeded, which is shown in a blue colour in fig. 3.

However, the circumferential region still reflects very strongly, since only low compressive stresses occur there. Only with the increase of the axial force after 6 s and the following shortening of the components the entire face becomes permeable to sound waves.

The usefulness of the measurement setup was shown in a further experiment. A sample was used with corrosion in the centre of the surface to be welded.

The phased array image of this weld differs significantly from the previous one. As shown in fig. 4, clear reflections still occur in the centre of the joint surfaces even after 2 s.

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The diameter of the reflecting region also increases after approximately 2.8 s until only weak signals can be detected after 3.5 s.

The reason for this may be the dissolution of the corrosion layer due to the increase in temperature. In addition, there is a possibility that the boundary was removed and torn into smaller particles which spread into the welded region.

The results illustrate the potential resulting from the application of the phased array measurement technique during the friction welding process. The detailed spatial resolution of the corrosion layer would not have been possible with any of the existing approaches used for process monitoring during rotary friction welding up to now.

As well, in further experiments, it could be detected that ultrasound findings make it possible to distinguish between unplaned and plane-turned faces.

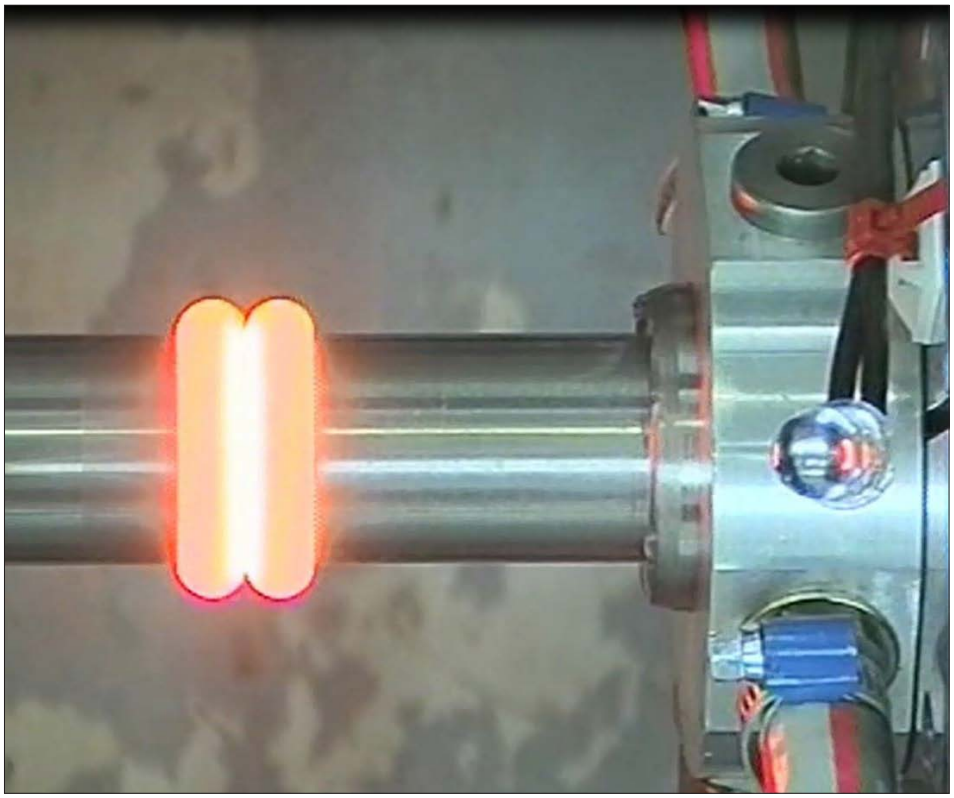


Fig. 5: Welding process with final weld (screenshot from Video)

Authors:
M. Keßler[1], M. F. Zäh[1], I. Bonifert[2], H. Rast[2], W. Roye[2], Stefan Kierspel[2]
[1] Institute for Machine Tools and Industrial Management (*iwb*), Technical University Munich
[2] KARL DEUTSCH Pruef- und Messgeraetebau GmbH + Co KG

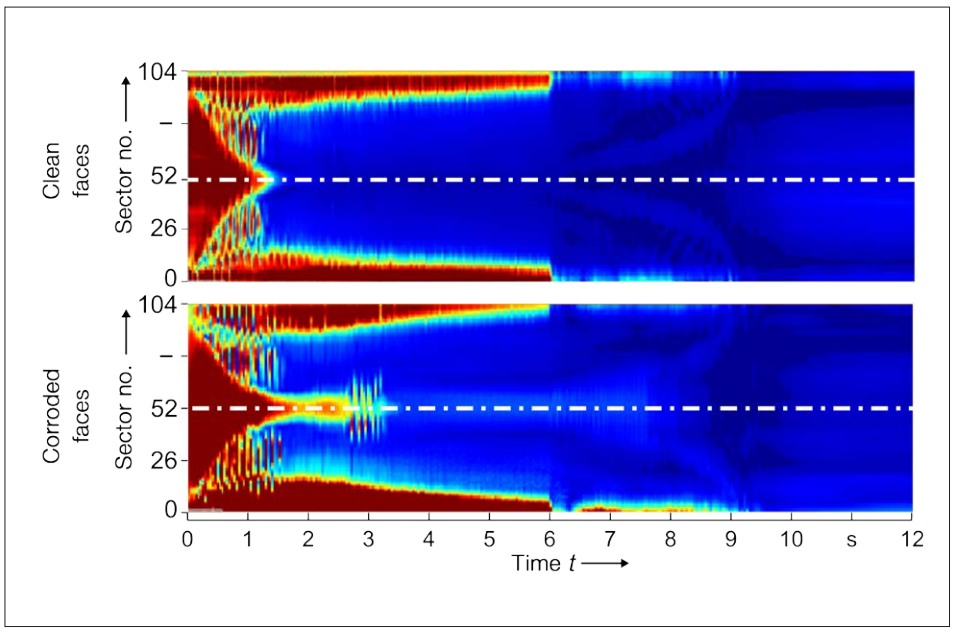


Fig. 4: Test results for a good weld (top) and a sample with corrosion (bottom)

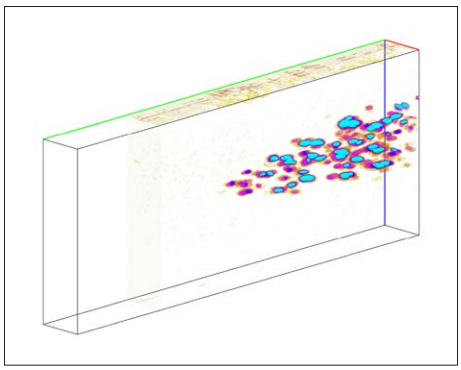
www.karldeutsch.de » Products » Phased Arrays (UT) » Instruments and Systems » GEKKO

Ultrasound Simulation and Analysis with CIVA

The software tool CIVA UT from the company CEA List, France, is used worldwide to simulate ultrasonic inspections, as well as to analyze data acquired during inspections.

Complex ultrasonic applications, conventional as well as with phased arrays, can be preliminarily simulated using detailed models. The results then may be used as a starting point for developing and constructing components and systems for the ultrasonic inspection. This approach has the advantage that you are able to virtually optimize a transducer before actually building it physically.

Furthermore, models of components including flaws can be built and inspected by means of a simulated ultrasonic examination with the CIVA tool, employing and studying the effects of varying parameters. Thus, the laborious construction and fabrication of specimen and inspection setup can be reduced to a minimum. It is also possible to perform studies of the probability of detection (POD). Therefore inspection systems can be optimized prior to the actual development.



3D visualization of ultrasonic data with CIVA Analysis

The module CIVA Analysis offers various tools for 3D visualization and automated sizing of ultrasonic inspection data acquired with portable phased array instruments such as the GEKKO. In conjunction with the simulation module, ambiguous indications (for instance wave mode conversions) can be checked and verified.

In the context of an in-house training by the CIVA sales organization EXTENDE, six staff members of KARL DEUTSCH from the departments Applications Laboratory, Systems Engineering and Transducer Development were introduced to the details of simulation of ultrasonic inspection and analysis of ultrasonic inspection data with CIVA.

The acquired knowledge will be used to develop customer-specific solutions like ultrasonic inspections systems and special transducers more effectively and efficiently.

The possibility to offer the GEKKO in combination with the CIVA Analysis module extend the evaluation and sizing possibilities beyond the many tools the GEKKO already offers. **Ki**

CIVA training by an EXTENDE consultant

www.karldeutsch.de » Products » Phased Arrays (UT) » Instruments and Systems » GEKKO

Presentation with the German NDT Society in Dortmund: A Nice Tradition for the End of the Year

Regular technical presentations are organized by the German NDT society (DGZfP) in many locations. The 366th meeting in Dortmund, Germany, took place on December 6th, 2016, in the large lecture room of the DGZfP training centre. Approximately 80 guests joined this meeting. The company KARL DEUTSCH traditionally supports this event with presentations and instrument demonstrations.

After the introduction by the deputy chairman of the DGZfP Dortmund local section, Rolf Feldbusch (Pelz GmbH, Moers Germany), and the director of the Dortmund DGZfP training center, Gerhard Stremmer, a technical presentation by Dr. Wolfram Deutsch (CEO of KARL DEUTSCH) was given.

The presentation with the title "NDT Applications, Portables and Systems (methods UT MT PT)" started with a company portrait and some information about mentionable projects in the city of Wuppertal, such as the new skytrain coaches and the reconstruction of the main train station.

The revised UV-LED large area lamp with a highly uniform light density, the multi-channel precision wall thickness measurement with the ECHOMETER 1077 rack and the new options strip chart, TOFD and B-scan of the ECHOGRAPH 1095 ultrasonic flaw detector were introduced. Special features of the GEKKO phased array flaw detector, such as the total focusing method (TFM) were also discussed.

Subsequently, a large ultrasonic testing system (type ECHOGRAPH-RPTS) for the rotational inspection of steel bars with 24 probes was presented. Two sets of probes with different frequencies (2 and 4 MHz) can be selected. This selection is fully automated and the respective probes are pneumatically moved between test and idle position. Steel bars with diameters between 120 mm and

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Dr. Wolfram Deutsch presents various NDT applications to the interested audience

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500 mm and bar lengths between 4.5 m and 18 m are inspected for 0.8 mm FBH (surface region) and 1 mm FBH (core region).

As examples for magnetic particle testing systems, a machine in turn table design (type DEUTROMAT) for steering pinions was described. Eight rotating workpiece holders, each designed to carry two workpieces, provide a high throughput. Also, a project where the crack evaluation is carried out by means of cameras was mentioned briefly.

Finally, a fully automated penetrant testing system (type KD-Check System) was shown. All steps of the test procedure from part loading to the visual inspection are carried out automatically without operator action.

The second part of the technical session contained practical instrument demonstrations. Dr. Helge Rast and Stefan Kierspel from the KARL DEUTSCH application laboratory brought many instruments and test pieces. By means of an immersion tank, the multi-channel precision wall thickness measurement by means of the ECHOMETER 1077 Rack was demonstrated. Strip chart recording and the TOFD-method were shown for the ECHOGRAPH 1095. The GEKKO phased array flaw detector was used to demonstrate the inspection of austenitic welds with matrix probes and for corrosion mapping with a 2-axis-scanner.

The KARL DEUTSCH chocolate Santas wait to be taken home

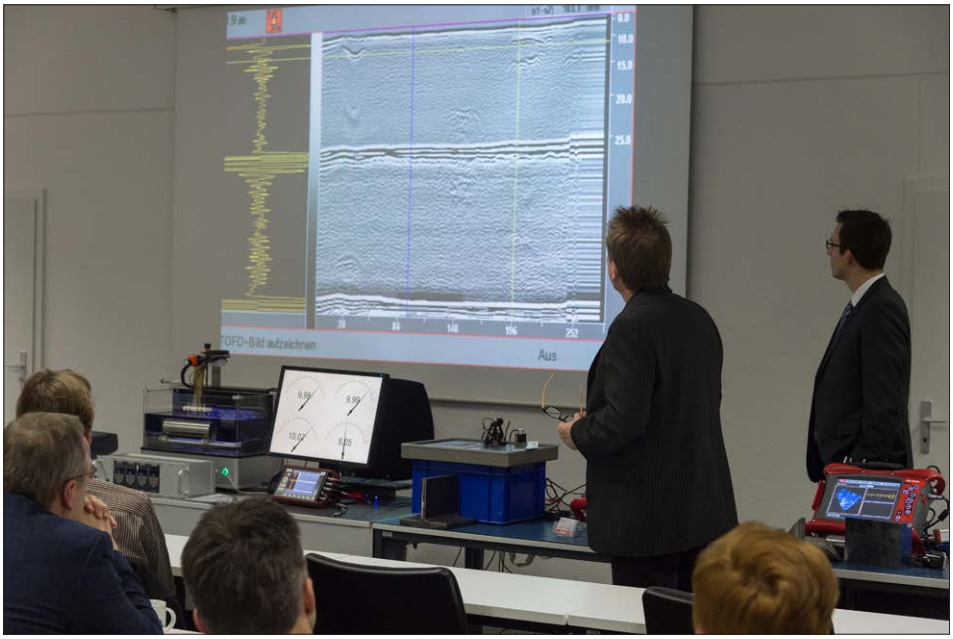
Finally, Dr. Ralf Wagner and Stephan Robens from our chemicals department demonstrated surface crack detection with FLUXA magnetic particles and KD-Check penetrants.

After these interesting and informative presentations and a lively discussion all participants were invited by KARL DEUTSCH for dinner. Many technical and private discussions were held at the sumptuous buffet. Since the 6th of December is St. Nicholas' Day in Germany, a sufficient number of chocolate Santas were provided for everybody to be taken home.

Video impressions of this nice evening can be found online under the following link:

www.youtube.com/watch?v=LK9qNwEsJkc

Ki

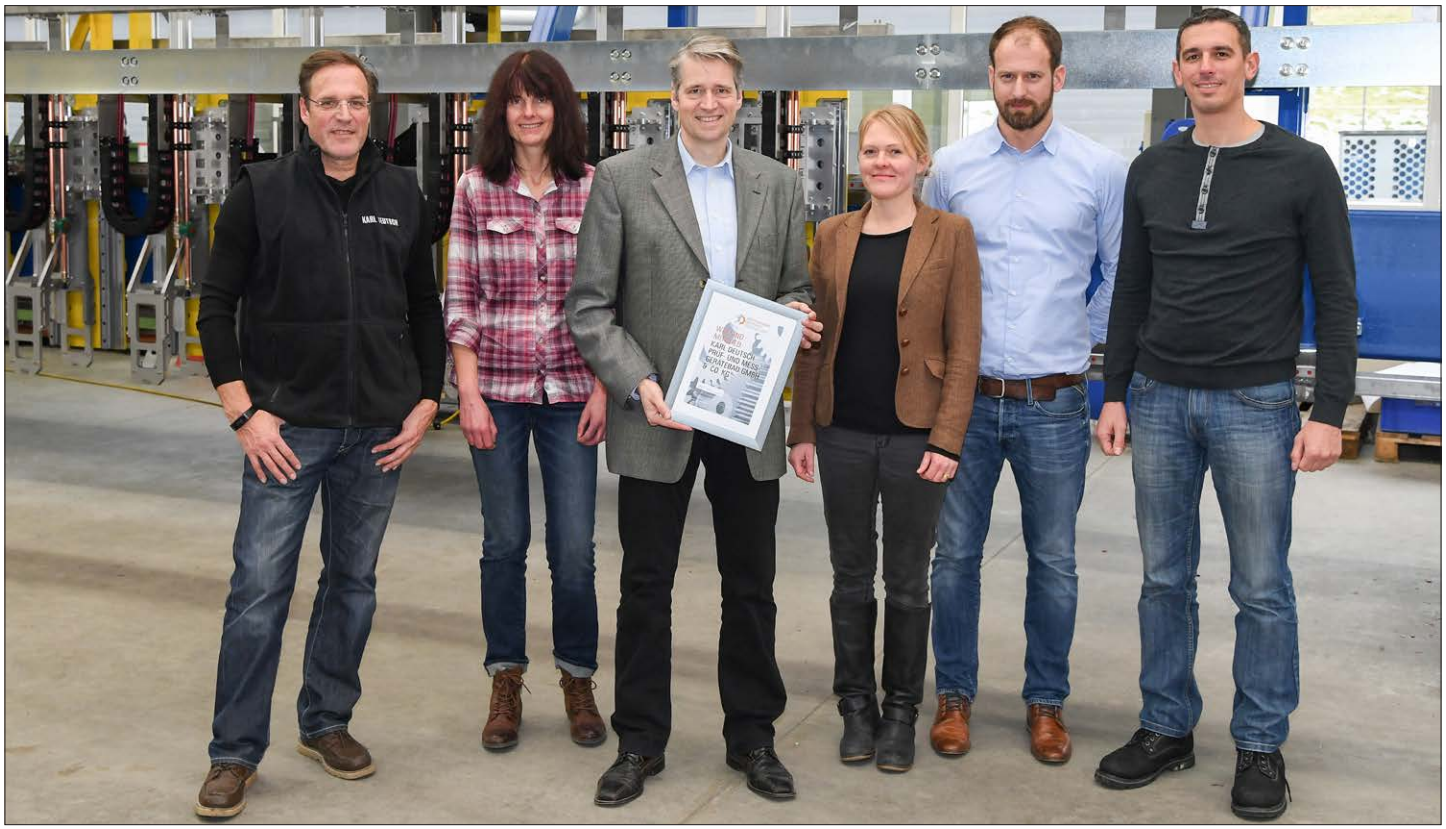


Stefan Kierspel and Dr. Helge Rast demonstrate the TOFD feature of the ECHOGRAPH 1095 flaw detector

www.youtube.de » NDTChannel » General » DGZfP AK-Sitzung Dortmund am 06.12.2016

Maschinenbaunetzwerk* Bergisch Land** – True Added Value by Joint Activities

The mechanical engineering industry is a central industrial sector in the Bergisches Land and is active in the global competition as a provider of high-quality products. As well it is regarded as an attractive employer in the regional context. By providing a network structure, the company Bergische Struktur- und Wirtschaftsförderungsgesellschaft mbH, as the driving force, wants to develop these strengths.



Handover of the Maschinenbaunetzwerk Bergisch Land certificate of membership with Jürgen Sand (KARL DEUTSCH), Claudia Arnold (KARL DEUTSCH), Dr. Wolfram Deutsch (KARL DEUTSCH), Gesa Eindorf-Evers (Maschinenbaunetzwerk Bergisch Land), Mathias Razeng (KARL DEUTSCH) and Marco Horn (CLEO GmbH)

The network is a platform that provides specific added value for the participating mechanical engineering companies of the region. As a part of the network, KARL DEUTSCH is not only given interesting impulses, but can also actively initiate projects to support and strengthen the positioning of the industry at home and abroad. The first projects have already been implemented together with partner companies. In particular, these projects benefit from KARL DEUTSCH's expertise in special machine construction in the field of non-destructive material testing. The range of services comprises the company's own design and construction departments, as well as the production of components and PLC programming. The special machines are manufactured at the Werk 2 site in Wuppertal and nowadays account for about 50 % of the total turnover.

Most important cornerstones of the cooperation are joint trade fairs, a close cooperation with the University of Wuppertal to improve the education of young engineers with respect to the demands of the industry, joint projects for recruitment and retention of specialists, a coordination of purchasing strategies as well as a general transfer of knowledge.

Thanks to this cooperation, KARL DEUTSCH has already been able to accompany some interesting projects. This year, there is another novelty in cooperation: For the first time ever, a shared tent at the Friedrich Engels Garden will be provided for the participants of several member companies at the Wuppertal Sky Train Race on July 2nd. Besides KARL DEUTSCH, the companies Berger Gruppe GmbH, CLEO GmbH and Maschinenfabrik Rausch GmbH & Co. KG will participate in the event.

However, in this case, the added value is "only" limited to a common meeting point and the good supply of the runners before and after the run. But hey - that's also a part of the network idea… **Hs**

* network of mechanical engineering
** name of the region around our hometown

Back to the Roots – But Always Looking Ahead!

Under this motto the KARL DEUTSCH New Year's Party 2017 was celebrated. Approximately 200 colleagues and members of the family took the chance to participate.

Dr. Wolfram Deutsch welcomes employees and guests

The event took place in the historic Wuppertal ELBA halls. Founded in 1917, ELBA is still a well-known brand for office material and folders, but the production in Wuppertal ended in 1998. Approximately 100 m from the ELBA halls was the starting point of the KARL DEUTSCH company. In the Moritzstraße, Ing. Karl Deutsch had his first office and his flat was directly above. Here, the adventure of Nondestructive Testing started in 1949.

Inspired by the historic background, a programme of classical music, comedy and dancing was arranged. The fantastic industrial setting provided many old and new stories from Wuppertal. The mixture of the now abandoned production hall and the modern furniture for the party created a special atmosphere. Lively conversations among the good-humoured guests were a perfect start into the New Year. Our guests of honour were the ones with the longest journey: Employees of our Chinese office KD-China and a delegation of our customer GEELY joined the party after a successful preacceptance of an MPI machine for crankshafts.

The ELBA halls are now being converted into modern office space. This project therefore fits well with the large-scale redesign of the entire city district called Arrenberg. Many real estate refurbishments in this area created a renewed and lively district in downtown Wuppertal.

KARL DEUTSCH readily helped with another Arrenberg project. The historic Moritz Bridge crossing the river near the ELBA halls is now illuminated in the evenings. This bridge in the centre of Wuppertal and located in the vinicity of many industrial landmarks, from the past like ELBA and bustling ones like Bayer AG, now also commemorates the roots of the KARL DEUTSCH company. **Hs**

A party in a historic industrial environment: A very special location!

Classical music is presented by young artists in front of a large graffiti

Rodin & Degas – Giants of Modernity Visit Wuppertal

They knew and they appreciated each other. They envied and admired each other. Their work represented grace and movement, body, space and time. They were fascinated by horses, women and photography. They were outsiders and rebels - and they were geniuses.

Racing to modernity, Edgar Degas and Auguste Rodin threw rules and norms to the wind, and then invented the path-breaking new direction.

Ridiculed at first, they were highly honoured in the end. They died in the same year, 1917, shortly after each other. Without them, modernity would not be conceivable. At the beginning of the year, the Von der der Heydt Museum in Wuppertal showed the two giants of Impressionism competing for the new in art, and juxtaposes them for discussion and confrontation.

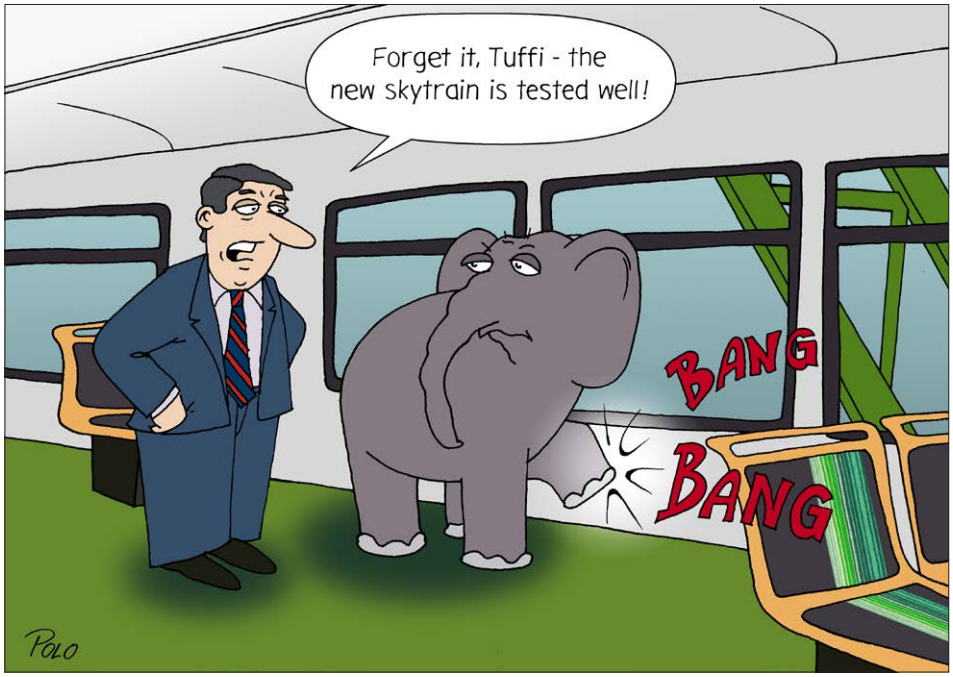
As a sponsor of the museum, the KARL DEUTSCH company was able to offer its employees a free visit to the museum, together with a highly enthralling guided tour.

Around 25 art enthusiasts explored the exhibition for about 3 hours and were impressed in the end. The film, exhibits and the lively presentation during the museum tour, everything together provided an exciting insight into a past epoch of art history enriched with everyday stories from the life of the artists.

As in the years before, the Von der Heydt Museum succeeded in conveying the fascination of great artists, their work and the contemporary circumstances, even to non art connoisseurs in an exciting and lively way. All participants were enthused and a visit is always recommended. **Hs**

Before visiting the exhibition: A group picture with a Tony Cragg sculpture

Cartoon



The illustrator André Poloczek, known as POLO, lives and works in Wuppertal. For this KD-Info he has humorously focused on the new skytrain model and the Wupper jump of Tuffi. During an advertising ride in 1950, the four-year-old elephant cow jumped from a carriage of the suspension railway into the Wupper river flowing 10 m below. No reason to worry: Apart from a few scratches, nothing has happened to Tuffi.

The new model of the skytrain

New Colleagues at KARL DEUTSCH

Sabine Hasenclever, a skilled Industrial Management and Foreign Language Assistant, has been actively supporting our export department since the 1st of December, 2016.

Since January 1st, 2017, Dipl.-Ing. (mechatronics) Julian Dölz has been responsible for software planning and electrical construction of ultrasonic testing systems at KARL DEUTSCH.

Tristan Neudecker (M.Sc.) joined the KARL DEUTSCH team on January 1st, 2017. He is specialised in Design and Automation Technology and takes care of the construction of MP systems.

Welcome to the KARL DEUTSCH team!

Trade Fairs and Events

22 - 24 May 2017
DGZfP Annual Meeting 2017
Rhein-Mosel-Halle
Julius-Wegeler-Str. 4
56068 Koblenz
Germany

25 - 29 September 2017
SCHWEISSEN & SCHNEIDEN
In 2017 welcomed as
guest in Duesseldorf
Duesseldorf Fairground

16 - 19 October 2017
26th testXpo
International Forum for Materials Testing
at Zwick company
August-Nagel-Str. 11, 89079 Ulm
Germany

13 - 17 November 2017
15th APCNDT
Asia Pacific Conference for
Non-Destructive Testing
Singapore

16 - 20 April 2018
Tube 2018
International Trade Fair for the
Tube and Tube Processing Industry
Fairground Duesseldorf
Germany

www.karldeutsch.de »
Dates and Events

About KARL DEUTSCH

KARL DEUTSCH
Pruef- und Messgeraetebau
GmbH + Co KG

The privately owned company KARL DEUTSCH was founded in 1949 and develops and produces instruments for non-destructive material testing. Portable instruments, stationary testing systems, sensors and crack detection liquids are produced by 130 motivated employees in two works in Wuppertal. Additional 20 employees in international offices and a worldwide network of dealers support the export business which accounts for more than 50% of the turnover. Characterised by continuous innovation and product reliability, the trade marks **ECHOGRAPH**, **ECHOMETER**, **DEUTROFLUX**, **LEPTOSKOP**, **FLUXA**,

Main Offices and Manufacturing Site for Portable Products (Works 1)

KD-Check and **RMG** are well-recognised. Our customers are metal producing and processing industries, e. g. steel works, automotive companies and bearing manufacturers. Typical test tasks are ultrasonic weld testing, detection of shrink holes in castings, crack detection in forgings with magnetic particles and dye penetrants, safety components for railway and aerospace as well as the wall and coating thickness measurement.

Offices and Manufacturing Site for Testing Systems (Works 2)

DIN EN ISO 9001 certified