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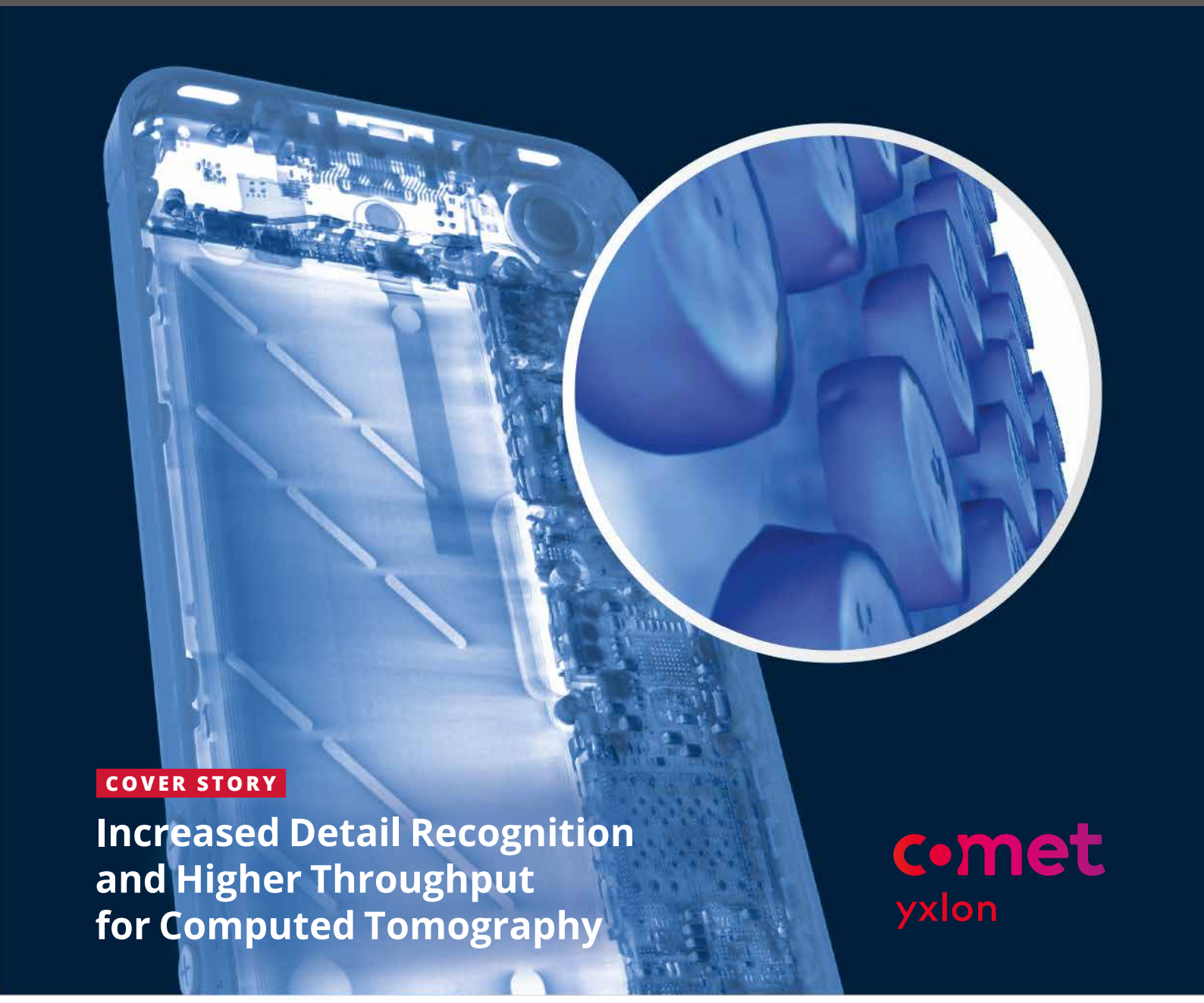
www.WileyIndustryNews.com



COVER STORY

Increased Detail Recognition and Higher Throughput for Computed Tomography

comet yxlon

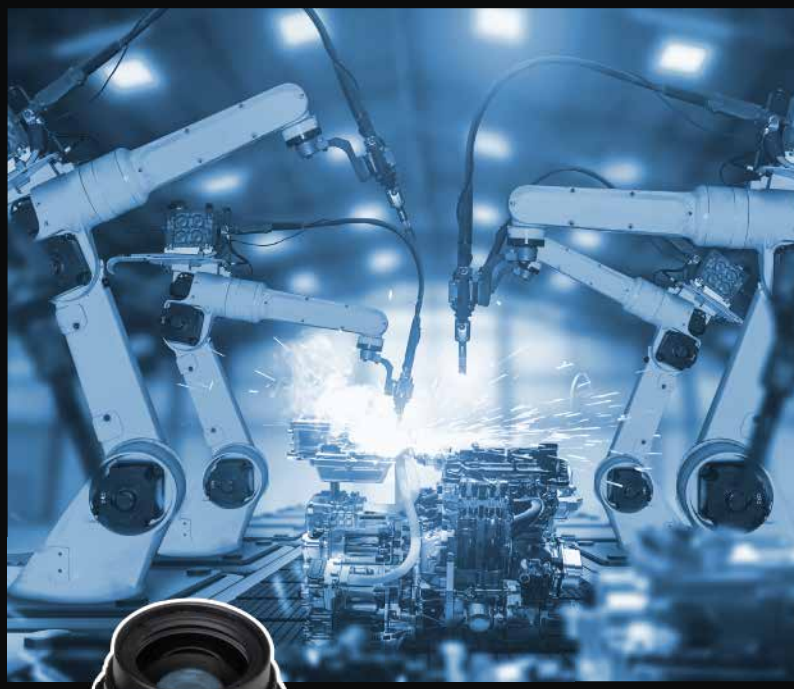
Partner of VISION AUTOMATICA Control emva VDMA spectronet

WILEY

FUJIFILM
Value from Innovation

FUJINON

HEAVY DUTY WITHOUT VIBRATION



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UKIVA machine vision conference & EXHIBITION
20 - 21 June 2023
CBS Arena, Coventry, UK

THE HF-XA-1F LENS SERIES

The lenses are designed without moving parts inside. This makes them extremely robust and particularly suitable for high vibration applications – for example in 3D/stereoscopic applications or in robotics. More info at www.fujifilm.com/de/en. **Fujinon. To see more is to know more.**

20 Years Ago

In 2003, many politically, economically, and socially relevant events changed the world we live in today. Just to pick two at random: The European Union (before 15 states) sealed the largest round of enlargement in its history in Athens. The ten new members were: Estonia, Latvia, Lithuania, Czech Republic, Poland, Slovakia, Hungary, Slovenia, Malta, and Cyprus. And, for cost reasons, the airlines British Airways and Air France decided to discontinue their flights with the supersonic „Concorde" aircraft after 27 years. The last flight took place on November 1, 2003.

Meanwhile, in the machine vision industry, Hongeng developed automated motion tracking and criminal act recognition, and several major industry players, Dalsa, Jai, Adimec, Atmel, Basler, Cyberoptics, Matrox, National Instruments, Photonfocus, Pleora Technologies, and Stemmer Imaging co-founded the GigE Vision Standards Committee standardized delivery of video and image data over Gigabit Ethernet networks – the first version of the standard was released in 2006. Moreover, in 2003 a very successful pan-European industry collaboration was manifested the first ever European Vison Business Conference that took place in Barcelona where the EMVA was founded, and the first Board of Directors was elected. Congratulations to EMVA's 20th anniversary this year!

The machine vision market has rapidly developed since, and it is expected to keep on growing strongly according to multiple sources, for example, Bloomberg estimates machine vision market size to be 18.24 billion US dollars by 2025, and McKinsey expects Industry 4.0 to deliver between 1.2 trillion US dollars and 3.7 trillion US dollars in value potential reach in 2025, globally. It is also expected industry 4.0 to create value equivalent to efficiency improvements of 15 to 20 percent.

«The machine vision market has rapidly developed since, and it is expected to keep on growing strongly.»

No wonder the industry is thriving – just read the articles in inspect and experience innovation and know-how all along the line. For example, this edition is headed by an article about Yxlon's software packages that open new horizons by optimizing X-ray methods for increased detail recognition and considerably higher throughput. Also, in an interview with Simon Smith, European Director of Aerotech, he tells us about the right way to go under difficult political circumstances, and how both direct contact with customers and flexibility can boost innovation.

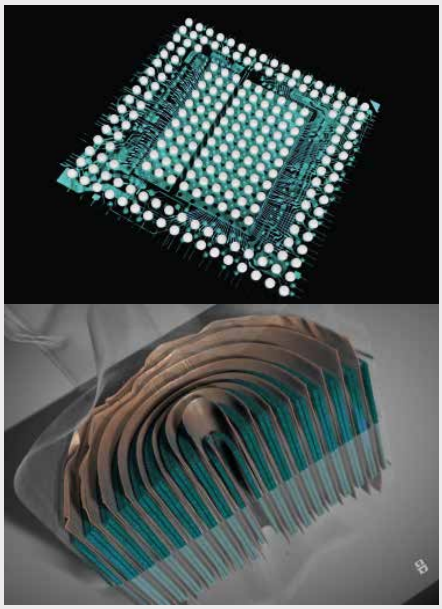
There is still plenty of room for development in many areas of machine vision – let's see what the next 20 years will bring. We will certainly be able to see many innovations at the upcoming trade fairs.

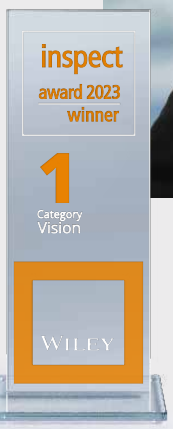
If you have a novel product or solution from the machine vision and/or optical metrology be sure to apply for the inspect award by April 30, 2023 at www.inspect-award.com.

Have a beautiful springtime and enjoy reading,

Yours,

Sonja Schleif





12 **Cover Story:**
The Next Level in Computed Tomography

16 "What Excites Me Most is to Act as an Entrepreneur and Drive Growth."

22 Get Measurement Technology Up and Running within 10 Minutes

10 Submit Your Product Now! Machine Vision Innovation Award

Contents

Cover: Comet Yxlon

34 Cameras Ensure Perfectly Placed Heat Sinks

Automation

Control

Partner of:

emva · spectronet · VDMA · Edge AI + Vision Alliance · VISION · Control · AUTOMATICA

Image: Visometry

Visometry CEO and co-founder Dr. Harald Wuest

Visometry Celebrates its Fifth Anniversary

As a Fraunhofer spin-off, the tech start-up specialized in augmented reality (AR) solutions for industrial applications in 2017.

Visometry company has its origins in the Fraunhofer Institute for Graphic Data Processing (IGD): Here the founders researched innovative AR tracking methods for more than ten years and developed the basis of today's VisionLib engine for reliable and stable object recognition. Starting from the core technology, today a team of passionate XR developers and experienced business experts develops and markets image processing solutions for industrial AR applications. With its products, it focuses on quality assurance in the manufacturing industry with the aim of significantly reducing testing and follow-up costs.

www.visometry.com

AMA Survey: Subdued Sales Expectations for 2023

In January 2023, the AMA Association for Sensor and Measurement Technology (AMA) surveyed its members on the economic development of the past financial year. According to its own statements, the industry generated a total sales increase of ten percent compared to the previous year. Incoming orders fell in the fourth quarter of 2022, one reason why the outlook for the 2023 financial year for sensor and measurement technology is more cautious. AMA members currently anticipate no revenue growth for fiscal year 2023.

In 2022, AMA members invested around 18 percent more than in the previous year and plan to increase investments by a further eleven percent for the current financial year. The industry representatives are thus setting an example for the future viability of sensor and measurement technology.

The export quota for sensor and measurement technology rose by 15 percentage points to 65 percent in 2022, after falling by twelve percentage points in the Corona year 2021. As a result, the export rate increased significantly again and is above the average export rate for industry, which totals 50 percent.

The number of employees increased by six percent in the past year.

The association asked its members about the level of difficulty in filling vacancies. The search for personnel in the areas of IT and research and development is proving to be particularly challenging. It takes AMA members an average of eight to nine months to fill such a position. It's a bit more relaxed in production and administration, these positions can be filled on average in three months.

www.ama-sensorik.de

Events

WHEN / WHERE	WHAT / WHO / INFORMATION
May 4–6, 2023 Seville, Spain	**EMVA Business Conference 2023** https://bc-2023.emva.b2match.io/
May 9–12, 2023 Stuttgart, Germany	**35. Control** www.control-messe.de/en/
May 22–25, 2023 Santa Clara, California, USA	**Embedded Vision Summit 2023** https://embeddedvisionsummit.com/

Image: ifm

Lothar Zimmer, CEO of ifm (left) and Christoph Müllner, former shareholder of CMS automation technology, at the notarization of the purchase agreement

IFM Buys CMS automation Technology

At the end of February, IFM took over CMS Automation Technology GmbH in Linz, Austria. With a total of nine employees, CMS offers automated data analysis for early damage detection and predictive maintenance. The two companies, ifm diagnostic and CMS, already have many years of experience in working together.

The new company, which will operate under the name ifm diagnostic services GmbH, will strengthen the "process" division at IFM. Andreas Hornstein and Michael Danitschek will be operationally responsible for the area together with the previous shareholder Christoph Müllner. In the "process" division, the central managing directors Lothar Zimmer and Hans Peter Müller are responsible for the new subsidiary.

www.ifm.com

Image: ic house

Dr. Alexander Flocke

IC-Haus Reorganizes Management

At the turn of the year 2022/23, IC-Haus reorganized its management. The longstanding technical director and co-owner Manfred Herz takes over the "pre-development" department in order to prepare creative solutions and circuit innovations for the chip design in close cooperation with the development department. At the same time, Manfred Herz is no longer active as managing director with immediate effect.

Representing the majority owner and managing director with sole power of representation, Dr. Heiner Flocke became Dr. Alexander Flocke named as another managing director of IC-Haus, who decides together with an authorized officer. Alexander Flocke received his doctorate in electrical engineering from RWTH Aachen University and has been working at IC-Haus since 2008, initially in chip development, then in applications and sales.

www.ichaus.de

Image: IDS

IDS Managing Directors Alexander Lewinsky and Jan Hartmann with Denkweit CEO Dr. Dominik Lausch and Arvid Moritz (Head of Business Development).

Denkweit and IDS Cooperate

The Fraunhofer spin-off Denkweit and the machine vision company IDS will join forces. Since the beginning of the year there has been a sales cooperation between the denkweit team from Halle an der Saale and the Obersulm industrial camera manufacturer. Both companies recognized each other in 2021, when the founders from Saxony-Anhalt drew attention to themselves at the AI competition of IDS' own online marketplace visionpier. Numerous startups presented solutions from the AI vision area. Denkweit convinced with an AI-supported surveillance system for security-relevant areas with the help of drones.

The versatile applicability of the underlying solution gave the team of physicists and engineers the opportunity to present themselves free of charge at the Vision image processing trade fair in the same year. Now both companies want to use what they have in common and the resulting synergies.

www.ids-imaging.de

Guideline Series VDI/VDE/VDMA 2632: Sheet 1 Updated

With the new edition of sheet 1 of the guideline VDI/VDE/VDMA 2632 sheet 1 published in January 2023, the terminology described therein was updated. The aim of the VDI/VDE/VDMA 2632 series of guidelines is to support users and solution providers in industrial image processing in the implementation of projects. VDI and VDMA have now published a new edition of sheet 1 that explains the basics and terms.

The series of guidelines VDI/VDE/VDMA 2632 "Industrial image processing" provides assistance to providers and users of image processing systems in joint project management. VDI/VDE/VDMA 2632 Sheet 2 has proven itself many times over when creating requirement and functional specifications. Sheet 3 gives important tips for the acceptance of image processing systems and Sheet 3.1 presents methods for testing the classification performance of corresponding systems. These guidelines are based on the terminology that is defined and explained in a generally understandable manner in sheet 1.

www.vdi.de

Surface inspection using image processing

Image: Vitronic

Photo: Systemtechnik Leber

Systemtechnik Leber expands management

Jörg Klenke and Stefan Betzold are now strengthening the company management alongside STL Managing Director Stefan Angele. Both come from within the company, where they work in sales and as head of the project management office. The role in management is associated with extended powers of attorney and was confirmed at a shareholders' meeting in early 2023.

Klenke and Betzold will remain active in project management, but at the same time will also be more involved in the strategic orientation and further development of the company. While Stefan Betzold primarily assumes the role of technology scout and internal driver of technical issues in addition to his existing function as head of the STL Project Management Office, Jörg Klenke will be even more involved in sales and marketing in his new position than before.

www.leber-ingenieure.de

Image: Allied Vision

Robert Franz is the managing director of Allied Vision and also manages the German 2D camera manufacturers within TKH Vision.

Robert Franz becomes CEO

Allied Vision, part of the TKH Group, has appointed Robert Franz as Managing Director. Along with this role, Franz will also assume the role of CEO for the German 2D vision companies within the TKH Group, which includes companies such as Chromasens , NET, SVS-Vistek, Mikrotron and Nerian. These companies all operate under the umbrella of TKH Vision.

Franz has many years of experience in companies in the automation technology and image processing industry. Among other things, he was Head of the global business unit Optical Sensing at Honeywell, President of Rittal in the Americas region and Senior. Vice President of Global Sales & Marketing at Datalogic . Franz is a lawyer and holds a Master of Business Administration (MBA) from TIAS Business School in Utrecht (NL).

www.alliedvision.com

Zebra Technologies now available from Rauscher

Rauscher has been a sales partner of the Canadian machine vision manufacturer Matrox Imaging in Germany and Austria for decades. With the acquisition of Matrox Imaging by Zebra Technologies in June 2022, the Olching-based distribution company's range of products has been expanded to include stationary barcode readers and other machine vision components from Zebra.

The family of stationary barcode readers and machine vision systems from Zebra enables automatic tracking of parts and packages whose codes must be reliably recognized and identified during production, warehousing and fulfillment processes, for example. From simple object tracking to complex quality inspections, Zebra's vision solutions include a range of intelligent cameras that meet all the requirements for economical automated processes.

www.zebra.com

Image: Rauscher/Zebra

Image: Viscom

The Markus Wilkens commercial agency takes care of the consultation, implementation and commercial processing of the projects in the agreed area.

Viscom presents trading agency for southern Germany

The Markus Wilkens trading agency is now looking after the company's customers in southern Germany: in their new role, he and his team will be present in the postal code areas 70, 72-73, 77-79 and 88-89 with immediate effect. These include cities such as Stuttgart, Tübingen, Reutlingen, Ravensburg, Freiburg im Breisgau and Ulm.

The agency works from Markdorf, not far from Lake Constance, and handles direct on-site contact with customers and interested parties for Viscom.

Before starting his own business, Markus Wilkens was the managing director of a leading supplier of board handling, laser markers, depanelers, printers and final assembly lines and was responsible for the American market.

www.viscom.de

Image: Smart Vision Lights

Steve VanderZwaag is as Vice President of Engineering responsible for the technical area of Smart Vision Lights.

New Head of Engineering at Smart Vision Lights

Smart Vision Lights promotes Steve VanderZwaag to head of engineering. VanderZwaag joined Smart Vision Lights in 2020 to lead the development and launch of the new electronic assembly department. "Steve's experience has allowed us to rapidly grow this new division, which now manufactures over 80 percent of our circuit board assemblies," said Dave Spaulding , President and CEO of Smart Vision Lights. After full launch, VanderZwaag assumed responsibility for managing the technical department. "Steve has demonstrated his ability not only to initiate and lead large projects, but also to direct the efforts of our engineering team," added Spaulding .

VanderZwaag holds a degree in Electronic Engineering and is passionate about developing technical professionals that support company strategy.

www.smartvisionlights.com

20th EMVA Anniversary

Celebration ahead at EMVA Business Conference in Seville.

The foundation of the European Machine Vision Association in 2003 was the beginning of an impressive success story of collaboration.

The EMVA celebrates its 20th anniversary this year. Two decades ago, the association was founded at the first ever EMVA Business Conference on May 24, 2003, in Barcelona. From that on, the EMVA Business Conference has grown to the pivotal European event of the machine vision community and has taken place in 19 European metropoles so far, including Seville in 2023. Moreover, two virtual conferences took place during the pandemic.

Serving the Vision Industry

In 2012, EMVA members during the General Assembly voted to separate from its former host VDMA and become an independent, non-for-profit, and member owned industry association. Since then, membership has grown to currently over 150 members. EMVA's activities focus on serving the interests of its members and have continuously broadened. Standardization became a pillar of the association's work, paving the way for the breakthrough of machine vision technology in so many industry verticals. The EMVA hosted standards GenICam and EMVA 1288 have become globally accepted and widely used standards and new standard initiatives such as OOCI address formerly unmet problems. Where necessary, the EMVA joined forces with new partners to cooperate on common standardization ideas such as with the Khronos Group to initiate an Embedded Camera System API named Kamaros. New meeting platforms were born like the annual European Machine Vision Forum that brings research and industry together and the Embedded Vision Europe conference addressing a mega trend in the years 2017 and 2019. Furthermore, it was already 10 years ago when the EMVA identified the need to support young talented vision tech professionals and initiated the annual EMVA Young Professional Award.

Joining Forces for a Truly European Association

The foundation of the EMVA was the result of a great European initiative. Already in the early 2000s the machine vision business had been very international with most of the vision companies being small or middle-sized and founder-managed companies. The time was ripe, and the industry was ready to join forces cross-border. In 2002, the General Secretary of the Machine Vision Group at VDMA and Gabriele Jansen, then member of the Board of this group, were tasked to take initiative and gather European support for a truly European vision association. Leading players from all over Europe were invited to send delegates into a European Vision Steering Committee. This was the start of successful pan-European collaboration. All aspects of competition were set aside and vision entrepreneurs from 12 European countries worked together for one year towards the ideation, the structure, and the mission of the European Machine Vision Association. In parallel this team planned the first ever European Vison Business Conference to take place in 2003 in Barcelona – where the EMVA was actually founded – and the first Board of Directors was elected.

Since 2020, Dr. Chris Yates is acting EMVA President, and together with General Manager Thomas Lübkemeier and the whole EMVA team they are looking forward to celebrating the 20th EMVA anniversary during the 21st EMVA Business Conference 2023 from May 4 to 6 in Seville/Spain, the country where the association was born two decades ago. More info about the conference program and registration can be found at http://www.business-conference-emva.org/. ■

Image: EMVA

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EMVA General Manager

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www.emva.org
Tel: +34 93 220 7201

inspect award 2023:

Submit Your Product Now!

Machine Vision Innovation Award

The application phase for the inspect award 2023 has begun. All machine vision and optical metrology companies are invited to submit their products by April 30. This year, the six winners of the two categories will receive a marvelous trophy.

At www.inspect-award.com, machine vision and optical metrology companies can submit their most innovative products free of charge to apply for the prestigious inspect award 2023. A jury of five experts will select the ten most innovative products in each of the categories "Vision" and "Automation + Control" from all the applications. The readers of inspect and all visitors of wileyindustrynews.com are then called upon to vote for the winners.

The total of six winners in the "Vision" and "Automation + Control" categories will then be awarded at the beginning of October.

20 Nominated Products are Presented in Detail in the June Issue

In the June issue of inspect (to be published on June 16) and on www.wileyindustrynews.com, the nominated products will be presented to the public in a prominent position. In the November issue, all winning products will be honored in detail. In addition, all winning companies will receive the right to use the coveted inspect award winner logo free of charge. So, it pays to take part. ■

Application deadline: April 30, 2023

The application phase for the inspect award 2023 runs until April 30, 2023. Apply now at www.inspect-award.com!

If you have any questions, David Löh, Editor-in-Chief of inspect, will be glad to answer them at david.loeh@wiley.com.

A Brief Introduction: The Jury

Anne Wendel
Since 2014, Anne Wendel has been responsible for the Machine Vision department at VDMA with around 120 member companies from Europe. Her work focuses on networking events, statistical analyses, standardization, press and public relations, and trade fair policy. In the latter function, she supports the further development of Vision and Automatica, for which the VDMA is the technical and conceptual sponsor.

Thomas Lübkemeier
Since 2013, Thomas Lübkemeier has led the Barcelona-based European Machine Vision Association (EMVA) as secretary general. He is an engineer in electrical/automation engineering and, among other things, was stationed abroad for several years for German companies and, after his return to Germany, was responsible as managing director for various foreign subsidiaries.

Prof. Dr.-Ing. Michael Heizmann
Even after his doctorate at the University of Karlsruhe in 2004 on a topic of image processing for forensic technology, Prof. Dr.-Ing. Michael Heizmann remained faithful to image processing for many years. Since 2016, he has been professor and institute director at the Institute for Industrial Information Technology IIIT at the Karlsruhe Institute of Technology (KIT). Since 2006, he has headed the technical committee 1.21 (formerly 8.12) "Image Processing in Measurement and Automation Technology" of the VDI/VDE Society for Measurement and Automation Technology (GMA), which publishes the VDI/VDE/VDMA guideline series 2632 "Industrial Image Processing". He is the scientific director of several conferences on industrial visual inspection and machine vision: EMVA's European Machine Vision Forum (held annually at different locations in Europe), Automated Visual Inspection and Machine Vision (part of SPIE Optical Metrology, held every other year in Munich), and Forum Bildverarbeitung (held every other year in Karlsruhe).

Paul-Gerald Dittrich
Paul-Gerald Dittrich holds an M. Eng. in electrical engineering/system design. After several years of research and development work as a research associate in the field of spectral imaging at the Ilmenau University of Technology, he supports the Imaging and Sensors Department at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF. In addition to project management, Dittrich is involved there with the development and application of so-called multimodal imaging sensors/systems. He also works as a project manager at Spectronet on the organization of project-specific collaboration between companies and research institutions that develop or apply image processing and photonics for quality assurance.

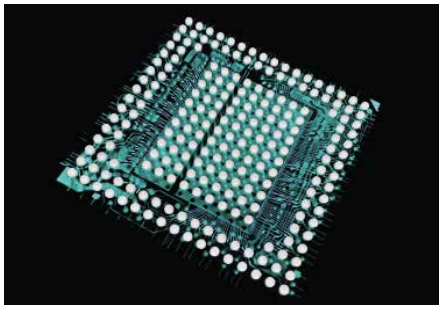
David Löh
After his journalistic beginnings at daily newspapers during and after his studies, David Löh took a liking to the world of trade magazines. He started out in the automation industry, which he left in favor of an exciting assignment at a plastics trade magazine. After another stint in a responsible position, he returned to automation industry at the end of 2019 to take over as editor-in-chief of inspect.

The Next Level in Computed Tomography

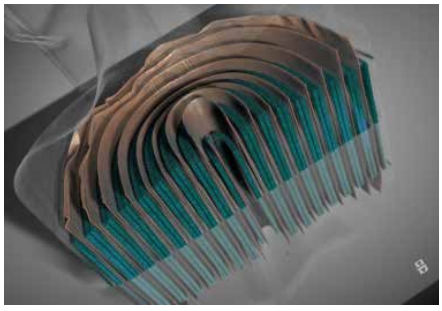
Software Packages Open Up New Horizons by Optimizing X-ray Methods for Increased Detail Recognition and Considerably Higher Throughput.

Obtaining a three-dimensional image of the interior of a component quickly is possible with an enhanced software package from a CT manufacturer. The image quality also increases significantly. This makes 3D computed tomography an efficient, fast inspection method.

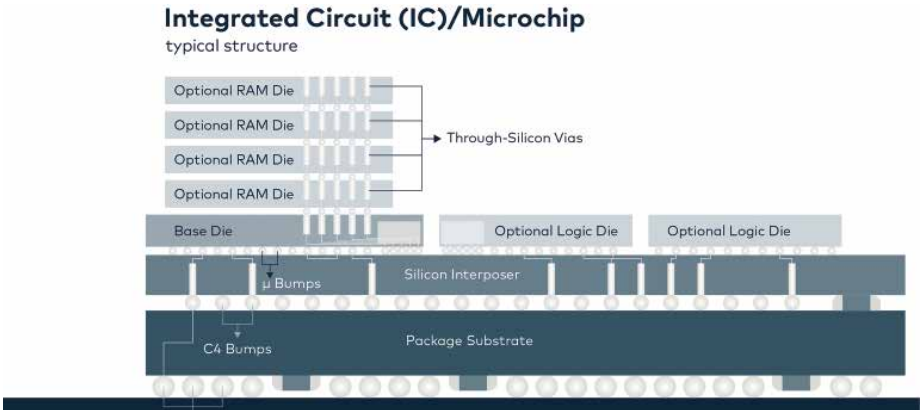
X-ray technology has established itself as the optimal inspection method in many areas of industry. In particular three-dimensional computed tomography, which provides a detailed, spatial image of the interior of the test part, is experiencing growing demand. Due to increasingly complex components in which functional structures overlap, two-dimensional radioscopy is not sufficient anymore. However, conventional computed tomography, in which the test part is scanned from many angles in a 360° circular scan, is relatively time-consuming and costly, and in particular the scans of flat components suffer from losses in detail detectability. Comet Yxlon has packaged optimized X-ray methods that deliver up to ten times higher detail recognition and up to five times higher throughput for just these components.



CT volume of a microchip



CT volume of a pouch cell



Typical microchip structure

Optimized Processes in the Semiconductor Industry

For some years now, especially the inspection of integrated circuits in the semiconductor industry and of batteries as the basis for electromobility has been gaining importance. It is not only a question of safety and functionality as well as the optimization of production processes with the help of the extensive CT data but just as much a question of efficiency and productivity in development and production.

In the case of microchips, it is primarily a matter of inspecting the electrical connections, be they wire bonding, solder balls (BGA), or silicon vias (TSV).

Even the solder balls (bumps) have several typical defects that can affect the function of the electronic component.

A prismatic or pouch cell is mainly inspected for cathode and electrode overhangs, deformations, foreign body inclusions, welds, and defects such as fractures and cracks, which is even possible with X-ray technology after the cells are installed in modules and the modules in packs. Defects in a battery cannot lead to performance degradation or shortened life only, but in the worst-case scenario, they may cause a fire due to a short circuit. Therefore, detailed and reliable testing of batteries before they are used is essential. In addition, the extensive CT data can identify trends that provide conclusions about the production process and allow direct intervention and correction to optimize it.

New Software Packages for Impressive Inspection Results

Specifically for use with its FF series high-resolution CT systems, Comet Yxlon has developed software packages that offer users fantastic inspection results at maximum speed and efficiency – integrated and easy to use via the intuitive Geminy software platform.

The basic Vista package includes the proven Quickscan mode for an initial overview of the test part and Qualityscan for high-resolution depth analysis. Flexcenter as a virtual rotation axis means great time saving when the ROI (Region of Interest), the area which needs to be looked at again in particular, is not in the center of the rotary table. The system calculates the required movements so that the ROI is in the center of the result without the user having to reposition the test part.

However, for chips and batteries, as previously described, the aspect ratios are 1:5 to 1:20, and the required information is located behind the large areas of the component. The customary circular scan spends the same amount of care and time on each angle, i.e.,

Defectuous solder balls can affect the function of electronic components.

just as many shots are taken on the narrow sides with great depth as on the informative wide sides with shallow depth. With the help of the new Speedmode in the Vista package, the user can define on which sides fewer projections are required for a meaningful result, thus speeding up the scanning process by up to three times. The examples shown here are scan results of a smartphone.

In the usual circular scan, the test part's widest side determines the minimum distance of the component to the X-ray components. This defines the diameter of the inspection volume and, in approximation, coincidently, the detail detectability. This is usually unfavorable for the application because the flat side could well achieve a higher magnification in the system and, thus, higher detail detectability. In addition to the Vista features described above, the Vista-X-package includes the so-called ZoomScan trajectory, which takes advantage of the SmartGuard available as standard in the high-resolution Comet Yxlon CT systems.

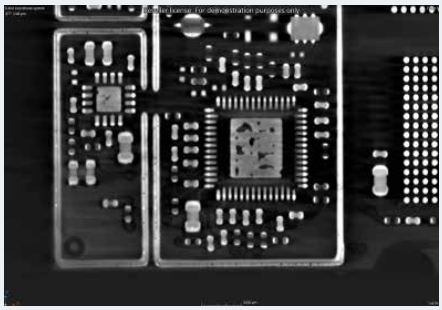
Defining Exact Dimensions

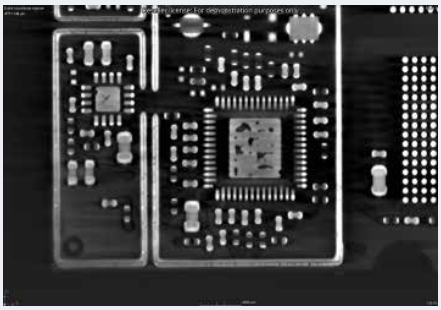
Originally developed as a tool for intelligent crash protection when positioning inspection parts, SmartGuard is used to define the exact dimensions of the inspection part. During subsequent scanning with ZoomScan, the system follows the concrete outline of the test part and achieves up to ten times the resolution of a simple circular scan. If Speedmode is activated too, the highest resolution is achieved at maximum speed.

The Vista-X-Pro-package additionally offers the Layerscan feature for optimum productivity. Layerscan is a special Comet Yxlon computed laminography solution. This efficient technology can produce high-resolution layer images of flat parts without requiring 360° rotation of the test part. This results in up to five times faster scanning speed while providing higher detail detectability. For some applications, it is disadvantageous that the resolution is lower in the beam direction. However, the typical artifacts that occur when radiating through the long edges in the usual circular scan are reduced, resulting in significantly more homogeneous layers in the image.

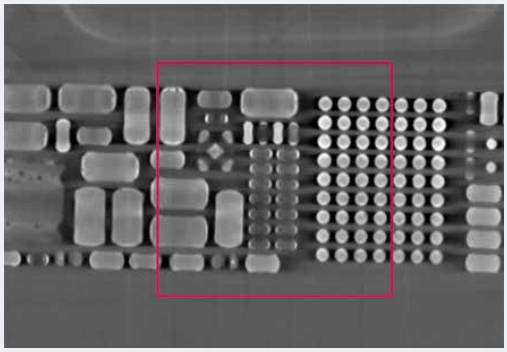
Increased Performance for X-ray Inspection

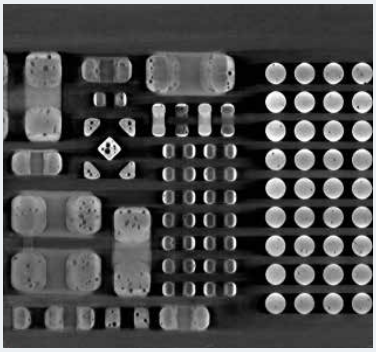
Overall, users who inspect flat and complex components such as batteries or electronic components experience a significant increase in performance for X-ray inspection with the Comet Yxlon Vista-X-packages, scalable to their requirements. The sophisticated software features, intelligently used and combined, ensure the best image quality with the shortest scan times and, thus, the highest possible efficiency of the inspection process. So, thanks to continuous further developments, a high-priced inspection technology such as computed tomography can help developers and producers achieve maximum throughput and minimum scrap and 'open up new horizons'. ■



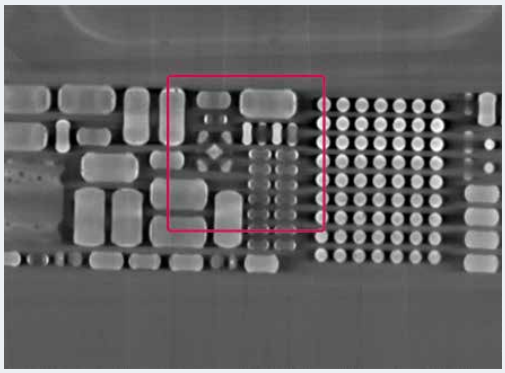


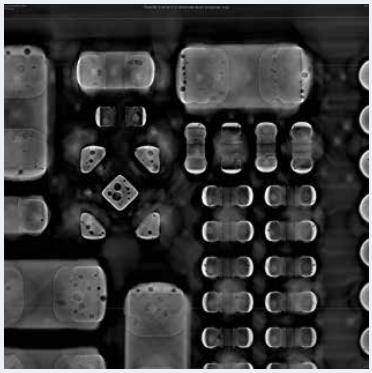
Qualityscan: 42 minutes scan time **Vista: 21 minutes scan time**
Up to three times faster scans (depending on the geometry of the part) without loss of quality





Qualityscan: 14 µm voxel size at 40 minutes scan time **Vista X: 2 µm voxel size at 30 minutes**
Up to 10 times higher resolution in less time than QualityScan





Qualityscan: 14 µm voxel size at 40 minutes scan time **Vista X Pro: 0.9 µm voxel size at 12 minutes**
Layer images of around ten times higher resolution and more than three times scanning speed

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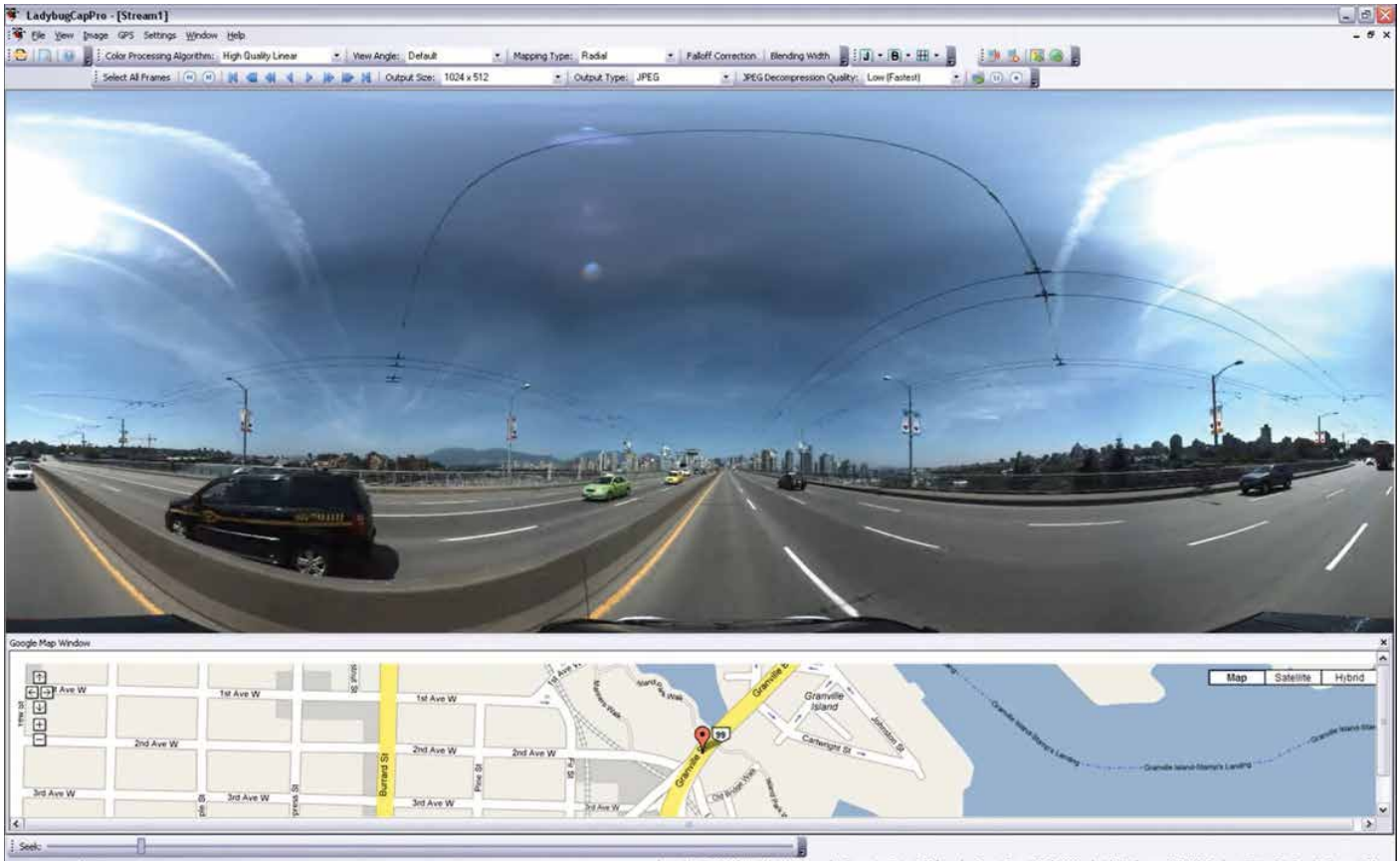
All Images: Comet Yxlon



Ladybug spherical image linked to GPS data

Accurate 360° Spherical Imaging

Multiple Pre-Calibrated Sensors Extend the Range of Application

Enabling applications to know where a camera is located in relation to the world raises it to the level of computer vision.

Today, the quality and flexibility of spherical video data make the medium ideal for applications requiring synchronization of video streams. The typical being GIS applications such as mobile mapping and street views colorizing Lidar generated 3D point clouds.

The Teledyne Flir Ladybug spherical imaging systems have become the de facto industry standard. The Ladybug systems do all the image acquisition, processing, stitching and correction necessary to integrate multiple camera images into full-resolution digital spherical and panoramic streaming video in real-time. This ability to stream in real-time is unique in the marketplace.

Multiple Cameras Synchronized

Where some systems use mirrors or fisheye lenses to create the effect of a panoramic view, the Ladybug systems use six cameras with high quality image sensors to truly deliver images gathered from six vantage points for 90 percent of the full sphere. Five sensors are positioned in a horizontal ring, and one is positioned vertically pointing upwards. The six cameras are pre- calibrated; this is the pivotal technology that allows the many other innovations within the system to be possible. Since lens settings, such as focus and iris, are fixed to ensure the camera stays calibrated, there is no need for in-field calibration.

The cameras are controlled by the Ladybug API as part of the SDK. It allows for complete control of the camera, graphics rendering, and coordinate system overview. Graphics rendering support includes real-time rectification, stitching and blending. System coordination allows users to manage each of the six sensors independently. Lastly, the SDK allows users to integrate the system with their custom applications.

Geometric-Based Calibration and Accuracy

Rather than relying purely on mechanical calibration, the systems use software to calibrate each camera on its own and in

High-Accuracy Spherical Imaging

Ladybug6 is a high-resolution camera designed to capture 360-degree spherical images from moving platforms in all-weather conditions. Its industrial grade design and out-of-the-box factory calibration produces 72 Megapixel (MP) images with pixel values that are spatially accurate within +/- 2 mm at 10-meter distance. As the newest member of Teledyne Flir´s field-proven Ladybug series, the Ladybug6 builds on our machine vision heritage with increased image resolution, enhanced on-board processing, and robust IP67-rated connectors. Support for additional Global Navigation Satellite Systems and advanced APIs, combined with hardware inputs, enable precise camera settings and trigger control. Customer applications include panoramic street image production, road surveying, asset inspection, feature extraction for HD map generation among several others.

Images: Teledyne Flir

relation to each of the other five cameras. Therefore, they are able to know the vector associated with every pixel, in each camera, to one-hundredth of a degree accuracy. This in turn enables applications to know where the camera is in relation to the rest of the world. In order to be able to provide this relational data, Teledyne Flir not only solved the problem of calibrating the lenses but also solved the greater challenge of calibrating the rotations and translations between all six lenses to high accuracy, a problem that is made harder by the small overlap between cameras' fields-of-view.

The geometric accuracy of the Ladybug calibration means that image data is spatially consistent across the whole sphere not just across the stitching seams. This allows the associated software to render any partial view of the video sphere without lens distortion effects being noticeable, even if that rendering spans multiple camera images.

The decision to use software correction rather than precise mechanical alignment means that Ladybug cameras can be assembled with an efficient and reasonable

Ladybug6 spherical imaging camera

Ladybug imaging mapped to Lidar point cloud

requirement for mechanical tolerances. The manufacturer has also automated the factory calibration process that produces extremely consistent and reliable results. The mechanical design and automated calibration has made production of the cameras very scalable and can adapt to changing demand. Additionally, the factory calibration and robust case design removes any requirement for in-field calibration. The cameras are calibrated once, in the factory, and then housed in a unique ruggedized casing rigid enough to resist changes in temperature, vibration and shock. Therefore, the calibration stays intact, and in-field calibration is no longer necessary.

Benefits of Calibration

The ability to enable applications to know where the camera is in relation to the world takes the camera beyond being a camera that simply produces panoramic images and into the realm of computer vision where it opens up a wide range of possible applications.

Post Processing Workflow for Maximum Dynamic Range

With the Ladybug5+ image-processing moves from the camera to the host PC where users control the outcome. The Ladybug5+ and Ladybug6 cameras capture, compress, and transmit full bit depth (12-bits) images to the host PC. The Ladybug Cap Pro's post processing toolbar is used to apply white balance, gamma, smear correction, fall-off correction, and other image processing functions. Users are able to make decisions and experiment with settings as they view the images and watch the effects in real-time.

Benefits of Post Processing

This capture and post workflow model allows users to maximize dynamic range and maintain flexibility by being able to return to the original content and re-apply post processing steps as desired. ■

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Robert Franz is managing director of Allied Vision and CEO of the German 2D camera manufacturers within TKH Vision.

"What Excites Me Most is to Act as an Entrepreneur and Drive Growth."

Interview with Robert Franz, CEO of Allied Vision and the 2D Vision Group at TKH

Since the beginning of the year, Robert Franz has been Managing Director of Allied Vision and also heads the German 2D camera manufacturers within TKH Vision. Now he talks with inspect about his plans for the companies and his priorities.

inspect: You are a lawyer by background. How did you end up in the automation world?

Robert Franz: Coming from a family company background I have always been inspired by entrepreneurial spirit and building great businesses. That spirit drove me to complete an MBA in the Netherlands and then join Honeywell, where I had the chance to lead world class organizations in several industries. Throughout my career I have now lived in 6 different countries, running global organizations. But I always go back to my first experience in our family business: What excites me most is to act as an entrepreneur and drive growth.

inspect: You are currently gaining your own impression of Allied Vision and the 2D companies of the TKH Vision Group. What is your interim conclusion?

Franz: Allied Vision, as part of TKH Vision and the TKH Group, comes with a great history in the machine vision industry and is today already one of the leading players, offering cutting edge technologies and products to our global customers. In combination with the strength of the TKH Vision group of companies we have a unique growth potential, serving the automation mega trend. I got the chance by now to meet many of our people on multiple occasions and am impressed with their spirit and capabilities. I am really happy and proud to work with our teams as we are further building out the leading position in our industry, serving our customers, and solving their problems.

inspect: What will be your first projects at Allied Vision?

Franz: We will definitely put further focus on building out the strengths of Allied Vision and of the 2D Vision Group, as well as the full potential of TKH Vision and TKH Group. We will put a very specific focus on serving our customers needs, and solving their problems. That always needs to be front and centre: creating value for our customers. And within TKH group we are uniquely positioned to do so.

All Images: Allied Vision

The development laboratory of TKH-Vision in Constance, Germany

inspect: In which areas do you want to further develop Allied Vision?
Franz: Beside the clear strengths we have already in place I am a big believer in modern Sales and Marketing. Moving forward we will put additional focus on the ways we reach our customers. Today we are meeting the most informed customers ever in history, and they are expecting the same B2B buying experience that they are used to from being a B2C consumer. We will strive to provide even more value and become the famous "trusted advisor" to our customers.

inspect: Where will the focus be for the further development of TKH-Vision?
Franz: TKH Vision is a group of leading companies in the fields of vision technologies and machine vision. Together they provide an unparalleled portfolio of products and solutions in critical applications and with that provide strong value to our customers in many different industries. TKH Vision group of companies has a unique growth potential, serving the automation mega trend. The vision industry is changing, and that creates many opportunities for our companies and our people. Within that framework, the TKH Solution Center is an organization that can leverage the full portfolio and capabilities of TKH Vision to design, develop and build unique solutions to our global customers' most challenging problems.

Allied Vision's Alvium camera platform for industrial machine vision and embedded vision systems.

inspect: How will the machine vision industry develop this year?
Franz: I believe that markets may continue to be challenging this year in some areas given the geopolitical situation and the general economic environment. Having said that, I don't see us as "victims of the market". We have nearly endless potential to move into new applications and convince new customers from our capabilities. So with that I am looking forward to continued growth for us. ■

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Simon Smith (r.), European Director of Aerotech, interviewed by inspect Editor-in-Chief David Löh.

"The Political Upheavals with China are Pushing our Business"

Interview with Simon Smith, European Director of Aerotech

The flexibility to respond to customers combined with robust supply chains and diversified markets. This positions Aerotech well for the future, Simon Smith, Aerotech's European director, is certain. Therefore, the political disagreements between the U.S. and China cannot shock him. On the contrary, he is seeing great opportunities for his own company, but also for Europe as a whole.

inspect: The previously pure sales office in Fürth was expanded into an assembly plant this year. What is the background to this?
Simon Smith: To take a step back: First of all, Aerotech has always offered solutions instead of electromechanical systems. So, sales is always about understanding what's important to the customer. And one of the things we have learned over the last few years is that it is very good to be flexible and to be able to produce in different locations. That has to do with personnel, with the availability of resources, and with the fact that you have large chunks of stone – we're talking about granite here – that you don't want to transport around the world.

The assembly plant in Fürth gives us more flexibility on site. For example, if they want to deliver a 3-meter-long axle, it is very difficult to transport it by plane, especially if there is a big chunk of stone attached to it. And by ship, it is just very slow.

inspect: Can you explain in a little more detail what is produced in Fürth?
Smith: When we have systems that have large pieces of granite attached to them, the Fürth plant gives us the flexibility to either manufacture in the U.S. or source the granite locally in Germany or other European areas and assemble them in Fürth. One of the first things we are looking at now is to expand the machinery on site. The reason for this is that we have some large customers in Europe who want flexibility: for example, they often don't know initially whether they want a turned part on top or not. We want to be able to react to this more quickly on site.

Apart from that, Fürth is about getting in touch with customers on site. One example: If a customer from Germany buys a large system, he may want to look at and check the system before he accepts it. A trip to the USA is much more expensive for him than a trip to Fürth.

inspect: So Fürth is a center in Europe, so to speak, right?
Smith: That's right, yes. It's not that we don't want to do it elsewhere, but there are not enough resources everywhere. We chose Germany because the people there have a lot of expertise. And besides, we also have the material there that we need for this task. Last but not least, Germany is known in Europe as an industrial location that offers high-quality solutions.

inspect: Which countries do you mainly export to within Europe?
Smith: We have two main offices, one in the UK and one in Fürth. The office in the UK looks after Scandinavia, the Baltic states, France and southern Europe, as well as the Middle East. Fürth serves the rest of Europe, which is essentially Eastern Europe as well as German-speaking Switzerland and Austria.

inspect: You mentioned Great Britain. That inevitably leads to a Brexit question: how will that affect your business?
Smith: If you were to ask me if I would have voted for Brexit, the answer would have been no. Simply because it's always better to have a common market to operate in.

Of course, Brexit also gives us flexibility as a country. But it makes life very difficult for us

All Images: Ralf Haaßengier

in terms of exports and imports. Also, we now have a barrier between us and the plant there in Germany: in addition to the customs duties we have to pay when the goods come to the UK, there are all the customs clearances you have to go through. Overall, there's just more bureaucracy and it costs more money now to do business across national borders. But there are already rumors in the United Kingdom that they could become part of Europe again.

inspect: How has Aerotech weathered the pandemic?
Smith: I think we've weathered the pandemic very well. We learned to innovate our business methods and function as a hybrid company: Many employees are continuing to work from home and do their jobs in online meetings, including sales calls.

I think we've also become more productive as a result. Still, there's nothing like a face-to-face meeting, a real encounter with the customer. And we're starting to do that more often again now.

That said, we did actually see a drop in immediate business during the pandemic. But that has more than recovered.

inspect: So, is Aerotech prepared for the next pandemic?
Smith: Absolutely, we're better prepared for it than we were last time. I think we've all learned a lot, and I think we can work from home in administration, for example. When that happened the first time, we weren't prepared for that. Now we have the hardware to do it. We have the appropriate solutions and some of the necessary procedures in place: Logging work, ensuring employee health, wearing masks, and so on.

inspect: What have Aerotech's biggest successes been recently?
Smith: It was a difficult time during the pandemic, but one thing I can say is that Aerotech has continued to invest in the future. For example, we launched a new control platform, Automation 1. We've been busy now for a long time transitioning customers from our existing control platforms to the new one, and I think that's been a big success that we've had.

In terms of the business, we have record order volumes, we've upgraded technologically, we've bought a new factory, we've moved into the factory, we've doubled our manufacturing space in the U.S., we've expanded and trained the team.... So, I think we've become a better company and we can offer more flexibility to our customers. And best of all, we have a smarter supply chain now.

"Aerotech's Automation 1 control platform is one of the product highlights of recent years", says Simon Smith, European Director of Aerotech

inspect: What is China's role right now, and what is the outlook?
Smith: Aerotech has an office in China. But our entire manufacturing takes place in Pittsburgh. We also do half of our sales in the United States. So, dislocations with China don't have a direct impact on us. But I think one of the areas where China hits us is in semiconductor manufacturing. So, we've had difficulty getting certain components for our devices. FPGAs and things like that. That's been a big problem in some cases.

But I think the bigger problem in this context is that the U.S. is no longer supplying certain semiconductor products to China. That has an impact on our markets in China and the rest of Asia.

But as far as the European markets are concerned, it doesn't have an impact at the moment and I would even say that it actually helps us more in Europe because we bring back production equipment from China to produce locally. It also actually pushes our business because there are new factories being built in the U.S. and each of those factories needs equipment that our customers supply.

inspect: What are the most important regions for Aerotech besides North America?
Smith: Europe and Asia share the other half of our business. That's why we are very balanced as a company. Another important factor is that we operate in several market segments. Some industries are just always going up, and a few others are always going down.

For example, we see that the semiconductor industry is cooling down a bit at the moment but other markets are picking up again: Optics, manufacturing and photonics. In the latter, there's a big effort right now to move from electrons to photons for processing units, and there's a lot of work being done on quantum computers and things like that that we're involved in.

inspect: What will Aerotech's next innovations be?
Smith: I don't want to get too specific about it, but I would say that the market is definitely heading toward what we're doing today. So, people want to produce things faster, and at the same time with higher precision. That hits at the core of what Aerotech does. We're investing in the future of new technologies to make sure we can take the next step. Whether it is in manufacturing technology or control technology. But when you put all those areas together, we are well positioned, and we have research and development programs that will support that. So, it is hard to say where the journey is going. Because we're already talking about being able to position much more precisely than others can measure right now. ■

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Image: Fujifilm

Lens Series in Heavy-Duty Design

Fujifilm has introduced the Fujinon HF-XA-1F series. The camera was specially developed for applications that require high shock and vibration resistance. The "heavy-duty lenses" are suitable for sensor sizes from 2/3" to 1/1.2" and image resolutions of up to 5 megapixels with a pixel size of 3.45 µm. The HF-XA-1F Series inherits the optical construction and performance of the HF-XA-5M lenses, but incorporates them into a new mechanical design engineered for the best possible resistance to shock and vibration.

The optical properties of the new series are identical to those of the HF-XA-5M series with a focal length of 8 to 35 mm – such as the high resolution up to the edge areas or the low distortion. The minimum object distance (from 100 mm) is extremely small and the image quality remains constant regardless of the object distance.

www.fujifilm.com

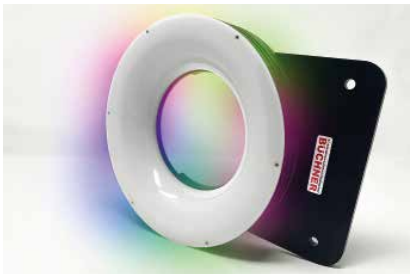


Image: Büchner Lichtsysteme

Ring Light With Two LED Light Rings

Büchner Lichtsysteme has introduced a new ring light with the IRIDA-180 LED lighting. There are two LED light rings under the curved diffuser. One for the visible RGB colors and a second for UV and NIR light. The number of LEDs could be increased to 136 due to the rings lying close together. This ensures extremely homogeneous illumination. In addition, both light rings are divided into four circular segments (quadrants), which can be controlled separately.

Due to the great variability, the IRIDA-180 is ideal for any test laboratory or for production environments with frequently changing components. Attached to a height-adjustable tripod, countless lighting conditions can be realized. Even shape-from-shading (SfS) for generating 3D data is possible with this lighting.

www.Buechner-Lichtsysteme.de

Image: Edmund Optics

Compact and Variable Gemma Beam Expanders

Edmund Optics has added the Gemma 2X – 8X 1,064 nm Variable Magnification Beam Expanders. The beam expanders were developed for laser applications with high laser power and tight spatial requirements, have fixed housing lengths and offer high laser damage thresholds. To minimize beam wander, an internal shifting and focusing mechanism is used, allowing magnification to be changed without rotating the lenses. The adjustable expansion between 2X and 8X makes it easy to determine the appropriate system enlargement in the prototype phase.

The beam expanders are designed for Gaussian beams, generate no ghost focus points and consist of a Galilean design with non-rotating lenses to offer high point accuracy in a very compact 158 mm body length.

www.edmundoptics.de

Image: Cognex

Barcode Reader for Logistic Facilities

Cognex has introduced the DataMan 580 fixed mount barcode reader, designed for the new five- and six-sided modular vision tunnels. This is a logistics tunnel solution designed to increase sorting throughput and reduce e-commerce and store processing times. All tunnels are pre-configured with reader modules and can be set up within a day, significantly minimizing downtime and enabling fast ROI in the entry, exit and sorting areas.

The Dataman 580 can be augmented with Cognex's Edge Intelligence tool to track real-time system performance and optimize downstream processes.

www.cognex.com

Image: Flir

Wireless Mobile Infrared Camera

Teledyne Flir has introduced the One Edge Pro, a wireless thermal imaging camera for mobile devices. It should offer a lot of flexibility for thermal imaging inspections. It is RESNET compliant, IP54 rated, and features a spring-loaded mount that allows it to be attached to a wide variety of smartphones and tablets. Thanks to the combined Bluetooth and WLAN connection, the Edge Pro can be operated at a distance of up to 30 meters from the mobile device. In this way, even hard-to-reach places can be inspected or scenarios with greater measurement distances for safety reasons can be implemented.

The Edge Pro is equipped with a radiometric Lepton thermal imaging camera with a resolution of 160 x 120 pixels combined with a visual camera.

www.flir.com

Image: Zeiss

Hand-Held 3D Laser Scanner

The Zeiss T-Scan Hawk 2 is a next-generation, lightweight, handheld 3D laser scanner. It is certified to the highest industry standards. It is a portable, reliable tool for data collection with metrological precision, regardless of where it is used: in quality control or reverse engineering, in maintenance, repair and overhaul. According to the manufacturer, it has a particularly simple and pleasant user interface. It is intuitive to use, adapts easily to hand movements and offers a workflow assistant as well as the option of starting and navigating the workflow directly. The user can operate the software directly via the system. The detour via the laptop is no longer necessary.

www.zeiss.com

Image: Lucid

IP67 Camera with Sony InGaAs Sensors

Lucid has introduced its new Triton SWIR IP67 certified 1.3MP and 0.3MP cameras. The Triton SWIR is a GigE - PoE camera with broadband and high-sensitivity Sony Sen-SWIR 1.3 MP IMX990 and 0.3 MP IMX991 In-GaAs sensors, capable of capturing images in both the visible and invisible light spectrum and has a miniaturized pixel size of 5 µm.

Triton's factory-tough design offers IP67 protection, Power over Ethernet (PoE) and offers protection against shock, vibration, water, dust and electromagnetic interference. It features active sensor alignment for superior optical performance, a compact 29 x 44 mm size, M12 Ethernet and M8 general-purpose I/O connectors for a robust connection, industrial EMI immunity, and a wide ambient temperature range of -20 to 50 °C.

www.thinklucid.com

Image: Pleora

Embedded Interface with GigE Vision

Pleora has introduced a new embedded interface that seamlessly transmits low-latency GigE Vision video and data at 10 Gbps over flexible Ethernet cabling. The Iport-NTX-Deca interface is intended for use in flat panel X-ray detectors (FPDs) for medical, dental and industrial applications, contact image sensors and high-performance machine vision cameras.

The embedded interface supports IEEE 1588 Precision Time Protocol (PTP) to synchronize image acquisition and imaging system elements with programmable logic controller (PLC) integration to seamlessly connect and control critical manufacturing or inspection system components.

www.pleora.com

icore
innovation to the Core
RAUSCHER
Bildverarbeitung

Image: Rauscher

Flash Controller for Fast Processes

Rauscher is expanding its range with the flash controllers from the South Korean manufacturer Icore and is now offering these products throughout Europe. Ultra-precise current pulses are one of the technical features of these high-performance LED controllers.

Particularly in the case of very fast inspection processes, it is important to control LED lighting with exact timing and with high current levels without overloading the LEDs. Depending on the model, the Ipulse controllers enable current pulses of less than 0.5 µs and currents of up to 200 A. Additional features such as extensive multi-strobe and auto-voltage functions make these LED controllers suitable for machine vision applications such as inspection of batteries, displays, electronic components, automotive products, or even line scan camera applications.

www.rauscher.de

Image: Allied Vision

MV Cameras with Sony Sensors

Allied Vision integrated the first-generation IMX global shutter sensors with Pregius sensor technology into its Alvium camera portfolio. With the camera models, the Sony IMX249 sensor is now also available in Alvium cameras with GigE Vision (Alvium G1-234), USB3 Vision (Alvium U-234) or MIPI-CSI-2 (Alvium C-234) interface. The faster Sony IMX174 sensor has also been integrated into the Alvium USB3 Vision camera series (Alvium U-235) and the Alvium CSI-2 camera series (Alvium C-235). The IMX249 and IMX174 sensors with a pixel size of 5.86 µm are known for their saturation power of 30000e-. They can capture a lot of light before they reach saturation, giving them a dynamic range of 73 dB. Along with the hardware release, users of Alvium CSI-2 cameras can benefit from a new version of the Software Development Kit Vimba.

www.alliedvision.com

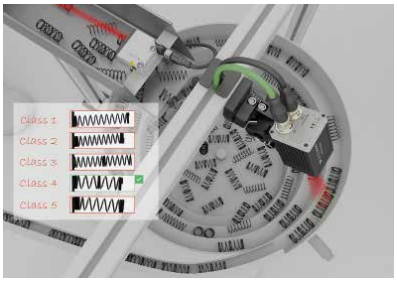


Image: Sensopart

Vision Sensor with AI Support

With the latest member of its Visor family, Sensopart wants to make setting up vision applications easier. Thanks to the artificial intelligence bundled in the “Classification (AI)” detector, the Visor Object AI independently learns characteristic distinguishing features based on a few images of the object to be detected. Even strong process and product variations such as fluctuations between batches, contamination, reflections, changing shape or varying 3D orientation can be taught with just a few mouse clicks. He is then able to reliably recognize the objects appearing in front of the lens and assign them to different classes. For example, in automobile production, he can differentiate between component variants and determine whether the right variant is available for a specific vehicle equipment.

www.sensopart.de

Image: Vision & Control

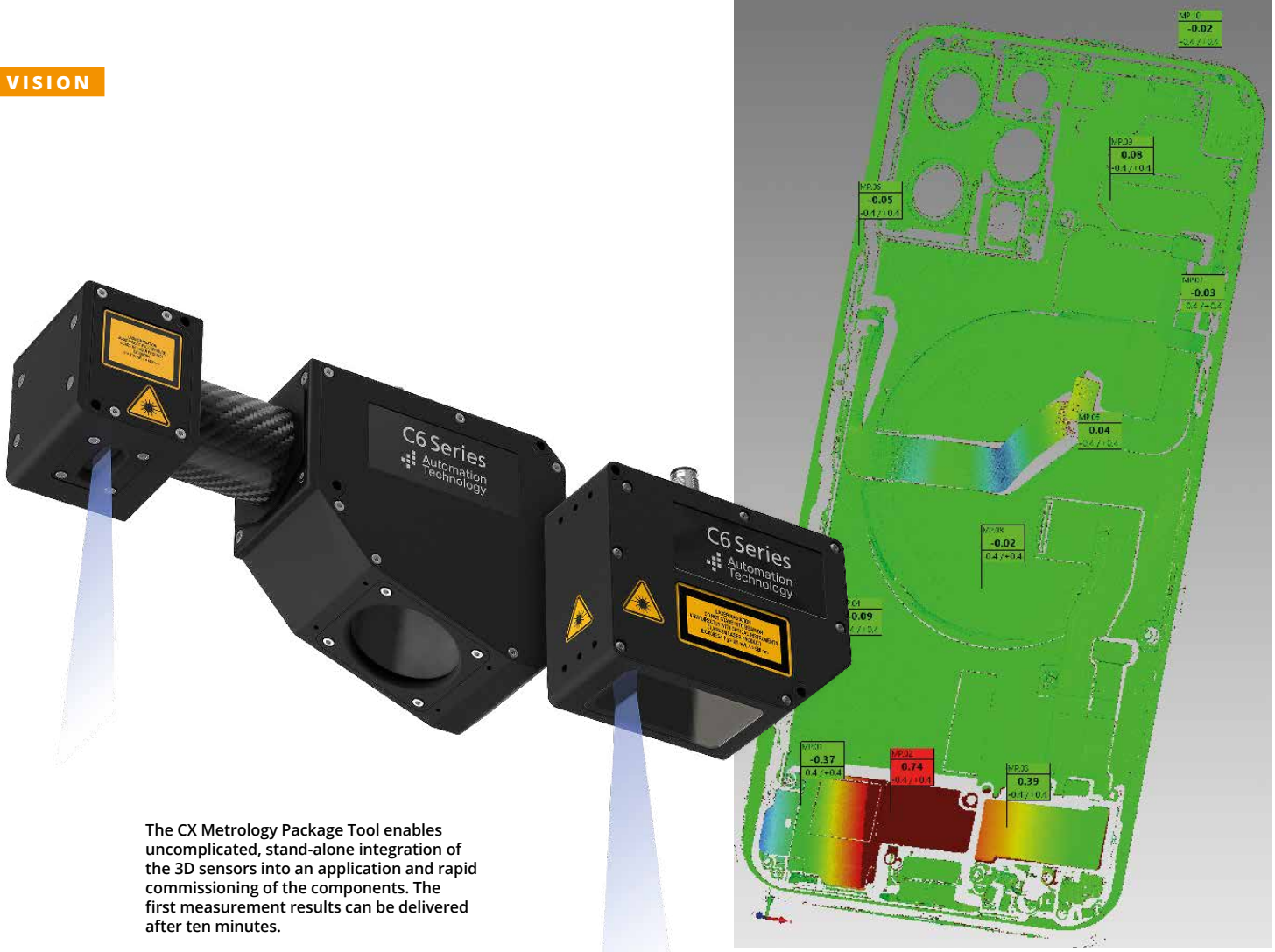
Telecentric Lenses with M42 Thread

Vision & Control now also offers its Vicotar telecentric lenses with an M42 thread. This means that cameras in DX and 35mm format also benefit from the advantages of telecentric lenses. The M42 thread is available for lenses from the Blue Vision series and microscope lenses.

Lenses from the Blue Vision series are characterized by the fact that their color correction has been extended far into the blue spectral range, recognizable by the suffix "BW" in the type designation. With blue light, they allow monochromatic image examinations with maximum sharpness and the greatest possible depth of field.

Microscope lenses can be recognized by the type name "TOM". These lenses are based on highly corrected microscope lenses for sharp, enlarged images, even of small object fields.

www.vision-control.com



The CX Metrology Package Tool enables uncomplicated, stand-alone integration of the 3D sensors into an application and rapid commissioning of the components. The first measurement results can be delivered after ten minutes.

Get Measurement Technology Up and Running within 10 Minutes

Software Package Speeds Up Metrology Applications

To speed up commissioning, a software package supplied free of charge with the 3D sensor supports the user. It contains numerous programs for metrology applications that can be quickly incorporated into the user's own solution. As a result, commissioning takes only a few minutes.

A new 3D sensor series, a new all-round software package, and a new software tool that takes the evaluation of metrology applications to a completely new level: 2023 is shaping up to be a particularly exciting and at the same time extremely diverse year for the North German technology company AT – Automation Technology from Bad Oldesloe near Hamburg. CTO André Kasper gives an initial forecast of what can be expected from AT, especially in terms of 3D developments, and why the beginning of the second quarter in particular is a hot phase:

„After we launched a new 3D sensor series in 2022 with our C6, which enables the world's fastest 3D profiling thanks to its WARP technology and its sensor chip that we developed ourselves, we have also not only expanded but also further developed our software for this. Together with our RnD team, we have succeeded in putting together our new AT Solution Package, a fully comprehensive software kit that combines all our previous software features and enables our customers to put their new 3D sensors into operation within ten minutes. With this SDK, which we plan to launch at the beginning of the second quarter, we hope to further simplify support for our customers," says the 53-year-old.

Reduced Effort for the Installation of the 3D Sensors

Until now, customers have always been faced with the challenge of detecting all defects simultaneously with one 3D sensor and then also finding the optimum software for evaluating these defects. In concrete terms, this means many new benefits for AT's customers: considerably less effort for the installation of the 3D sensors, a

All Images: Automation Technology

André Kasper, CTO of Automation Technology

After we launched a new 3D sensor series in 2022 with our C6, which enables the world's fastest 3D profiling, we also further developed our software for it. With our AT Solutionpackage, we have succeeded in putting together a software kit that combines all our previous software features and enables our customers to commission their new 3D sensors within ten minutes.»

much faster time to market and a much higher flexibility in terms of functionality and expandability of their applications.

One part of the above-mentioned AT Solution Package is the so-called CX Metrology Package. This new tool not only enables customers to easily and independently integrate the 3D sensors into their application, but also to commission the components in a timely manner. AT thus no longer just produces the 3D sensor for the 3D application, the company also provides support with the appropriate software.

Demo Programs Help with Commissioning

Consisting of a number of tools combined in the Metrology Explorer and a Metrology Software Development Kit, the customer receives an initial 3D image of his application within ten minutes and can then evaluate it immediately. In order to optimize commissioning and speed up evaluation, AT has stored a large number of demo programs in Metrology Explorer for optional evaluations that represent typical applications in the field of 3D metrology. With the help of these evaluation scripts, the customer can test the sensor live and adapt it in detail for his application solution.

With this novelty of evaluation options, which are supplied to the customer free of charge together with the hardware, AT is once again making a clear statement in the field of image processing. While competitors also offer evaluation options, a concept as open as AT's is unique. During testing, the customer can expand the evaluation of his application as desired until he has found the optimal solution for himself.

In addition, the customer has the option of ultimately extending this evaluation option and supplementing it with his own programming ideas. AT provides the Metrology Explorer also in source code. If the customer then wants to use this source code version or develop his own scripts, a developer license is required, which he can purchase as a paid option in addition to the free cxMetrology Package. ■

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Reassurance for Logistics

A Camera-Based Solution Simplifies the Registration of Incoming Goods in the Electronics Industry

Image: Comp Control / Background: shockfactor.de - stock.adobe.com

The automated WEControlDOME incoming goods station from CompControl enables companies in the electronics manufacturing industry to record incoming containers with absolute transparency.

The image processing for an automated goods receiving station is handled by a high-resolution GigE camera including an adapter for controlling the lenses used directly from the camera itself. This enables the flexible verification of goods with different dimensions.

Everything has to be effective and precise when companies in the electronics industry receive new deliveries in goods receipt. Only if the incoming goods can be checked with as little time as possible, product quantities and types can be booked into the merchandise management system and then stored in a suitable place, can the subsequent processing of the components be realized without further delays. Manual registration of incoming containers is usually too slow and too error-prone for this, making economical processes in this area almost impossible. However, automated solutions are usually not flexible enough to reliably identify the required data on the different geometric container formats of the incoming electronic components.

Comp Control IT-Service und Vertriebs GmbH, based in Gersfeld, Germany, solves this problem with its automated goods receiving station Wecontrol Dome. "We developed this system especially for electronics manufacturing to enable companies from this industry to record incoming goods from containers at an incoming goods station in an absolutely transparent manner", explains Comp Control Managing Director Christoph Limpert.

Wecontrol Dome determines data such as the order item, the article type, the quantity, batch numbers and all other information through a barcode and plain text analysis and verifies the recorded data by comparing it with the manufacturer information. Without further manual intervention, the system also takes over the automatic goods receipt posting in the merchandise management or ERP system and allows the integration of an automatic labelling system for the containers as well as their photographic documentation.

31,4 Megapixels Capture all the Details

According to Limpert, the unique feature of this system is the automatic capture of each individual container and the barcode and plain text information on it via an integrated camera, which, by use of an additional autofocus system, delivers images of sufficient quality even with objects of different heights. Such a system was necessary because the working distance for each image capture can differ from the previous data acquisition due to the different heights of the incoming packages. "This situation required a special setup of the image processing system, which we were able to realize with the help of SVS-Vistek", says Limpert.

After initial preliminary talks with the customer the experts from SVS-Vistek quickly found the camera optimally suited for this application in their wide product portfolio: the monochrome GigE camera exo342MGE, with its high resolution of 31.4 megapixels, met all the requirements for capturing the barcode and plain text information on the component containers reliably and in sufficient quality, as well as transferring the image data to the connected PC for evaluation and storage. Proven features such as the excellent thermal concept, which allows operating temperatures of up to 60 °C, and the integrated, versatile light control were further reasons for using the exo342MGE to solve the customer's task.

> The adapter enables the camera to have an autofocus function and thus creates the conditions for flexible, fast, and easy image acquisition.«

The main challenge, however, was to capture the images with the same quality despite the different heights of the test objects without having to intervene manually. The camera manufacturer solved this task with its SVS-EF adapter, a proprietary development of the company that allows convenient focus and aperture control of Canon EF-mount lenses directly from the camera. The adapter enables the camera to have an autofocus function and thus creates the conditions for flexible, fast, and easy image acquisition of incoming electronic containers regardless of their height.

Trend Towards Small Batch Sizes

According to Thorsten Schmidt, Head of Product Management & Support at SVS-Vistek, the application of the SVS-EF adapter at Comp Control represents a typical example of the function of this product: "In many industrial inspection solutions, fixed focal length lenses are still used. This makes sense in production lines where large quantities of one and the same part are manufactured and inspected over long periods of time. However, a completely different situation arises when inspecting parts with smaller quantities and frequently changing test objects: In these cases, an inspection solution must be quickly adapted to new products and parameters in order to ensure effective production."

According to Schmidt, at least since the introduction of Industry 4.0, the trend has been moving in this direction: "If, in extreme cases, the batch size drops to a quantity of 1, more flexible solutions are an indispensable prerequisite for the economic success of production companies. Focusable lenses are an important building block here, as they facilitate the inspection of objects with different geometric dimensions."

The adapter can be used in combination with numerous industrial cameras of the EXO, FXO and HR series to control focusable lenses with Canon EF or EF-S mount without additional hardware and software. The camera controls and supplies power to the lens, which is seamlessly integrated into the camera's GenICam tree from a software perspective. The EF adapter is available in different variants for lens mounts with C-mount, M42 and M58 and can be used with all cameras of the EXO, FXO and HR series from SVS-Vistek. "Users have a wide choice of camera models from our portfolio in terms of resolution, image acquisition speed and interface to optimally design their image processing system according to the requirements of the application to be solved and to easily implement flexible inspection solutions", Schmidt emphasizes.

Image source: SVS-Vistek

The SVS-EF adapter from SVS-Vistek enables an autofocus function of the camera used to capture images of incoming electronic containers regardless of their height.

Proven Solution

According to Managing Director Limpert, their automated goods receiving stations are already in use in large numbers and worldwide at many companies in the electronics industry. "After commissioning, these systems sometimes run in 3-shift operation around the clock at our customers and have proven to be very reliable there. In the rare cases of error, we always received support quickly and image processing-based problems were solved immediately. The good cooperation, that was already evident in the selection of components and the detailed feasibility studies during the development phase of the system, has also proven itself in the successful use of the goods-in stations." According to Limpert, there is reason enough to continue the partnership that has existed for more than a decade and also to rely on image processing from SVS-Vistek for future applications. ■

SVS-Vistek

(www.svs-vistek.com) has exceptional know-how in industrial image processing as an innovative manufacturer of high-quality industrial cameras for more than 35 years. The company develops and produces a wide range of standard cameras as well as cameras with the highest resolutions, above-average image quality and all relevant interfaces. With high-performance components such as lenses, illuminators, filters, frame grabbers and cables, SVS-Vistek supports customers in the realization of economical, individual and customized camera solutions for a wide range of industries.

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Image: Evotron

Telecentric Alternator

Evotron expands its product portfolio in the field of telecentric lighting. According to the manufacturer, the new series of telecentric LED high-performance lights TC-23xINF combines luminous intensity and precision with the intelligence of Lumisens technology. Packed in a robust and thermally optimized aluminum housing with protection class IP67, the lights emit telecentric light over an area of 23 mm in diameter. With a light output of more than 20 W, even short flashes of 1 µs are bright enough and enable the use of rather weak cameras or telecentric lenses. Telecentric lights of the TC-23xINF series are used wherever measurements or inspections have to be carried out with high precision and telecentric lenses in transmitted light. In high-speed applications, features can be identified or measured with micrometer precision.

www.evotron-gmbh.de

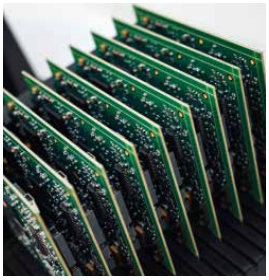

Image: Hema

Embedded Vision Prototype in a Few Days

Hema has the fast lane Boardservice presented for its Embedded Vision platform. Ideally, customers receive a functional prototype of their electronics after 30 days. To do this, customers select functionalities and interfaces in a workshop or using a configurator and define the board format. One or more System on Modules, for example from the AMD Kria series, can be integrated for variable computing power. Circuit diagram and layout are created based on the Hema Design Library with over 45 predefined building blocks. New and custom circuits can also be considered. The prototype will be delivered including a board support package with FPGA middleware, tools and demo applications. Customers can thus start developing and testing their end application in the shortest possible time.

www.hema.de

Image: IDS

Advanced 3D Camera Series Available

Anyone who chooses 3D cameras from the Ensenso N series from IDS now benefits from further developed models. The new Stereo Vision cameras (N31, N36, N41, N46) are available now. The Ensenso N 3D cameras have a compact housing (depending on the model made of aluminum or plastic composite) with an integrated pattern projector. They are suitable for recording both static and moving objects. With the Ensenso models N31, N36, N41 and N46, IDS is now launching the next generation of the previously available N30, N35, N40 and N45. Visually, the cameras do not differ from their predecessor models. However, they use a new sensor from Sony, the IMX392. This ensures a higher resolution (2.3 MP instead of 1.3 MP). All cameras are pre-calibrated for easy setup. The Ensenso selector on the IDS website helps to choose the right model.

www.ids-imaging.de

Image: AMD

ODM Ecosystem Program for Kria Portfolios

AMD has introduced the Kria SOM ODM Partner Ecosystem – a new program aimed at delivering production-ready, fully functional Kria SOM-based solutions that help customers get to market faster without the need for special Resources are required for the chip design. For the first time, the new Kria ODM Partner Ecosystem offers users a turnkey solution with a complete software stack and application support, backed by well-established and successful partners.

Adaptive computing with software and hardware programmability allows users to add new features and optimize system performance based on their needs, providing flexibility.

www.amd.de

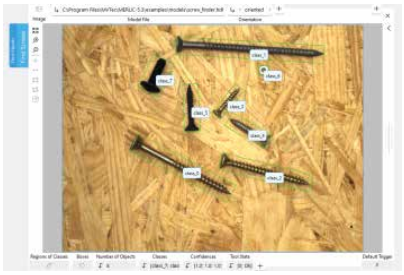

Image: MVTec

New Update for Machine Vision Software

MVTec will launch the latest version 5.3 of its easy-to-use machine vision software Merlic. For one thing, customers can look forward to a new deep learning feature. Secondly, user-friendliness has been further enhanced. These improvements are in line with the company's goal of offering powerful machine vision software for beginners as well. The deep learning technology for object detection is now also available in Merlic. The "Find Object" tool locates trained object classes and identifies them with a surrounding rectangle. Touching or partially overlapping objects are also separated, which allows counting of objects. Labeling and training are possible without programming knowledge using the free MVTec Deep Learning Tool. The trained network can then be loaded into Merlic.

www.mvtec.com

Image: Resolve Optics

Wavelength Corrected UV Zoom Lens

To provide inspectors with an effective tool for non-intrusive verification of spent nuclear fuel, a global leader in nuclear safeguards technology asked Resolve Optics to design a wavelength corrected UV Zoom lens to enable its Digital Cerenkov Viewing Device to view a nuclear fuel assembly situated 13 metres away from the lens and through 10 metres of water. Spent nuclear fuel emits a faint UV (Cerenkov) light when gamma rays from fuel assemblies interact with electrons in the cooling pond water.

To meet the challenges of this demanding application – Resolve Optics designed the UV zoom lens to optimally operate from 10 to 55 °C. By incorporating a telescopic focus in the design, the novel lens can image objects from 3 m to infinity. Miniature motors on the lens allow accurate remote setting of both zoom and focus functions.

www.resolveoptics.com

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Enabling Terahertz Light-field Imaging Using Fully Integrated Silicon Components

Development of a Modular THz LF Camera

Light-field (LF) imaging is a highly versatile computational technique for 3D scene reconstruction, depth estimation and content editing. Combining LF with terahertz detectors to perform real-time see-through imaging will lead to novel applications in security, medical and industrial applications.

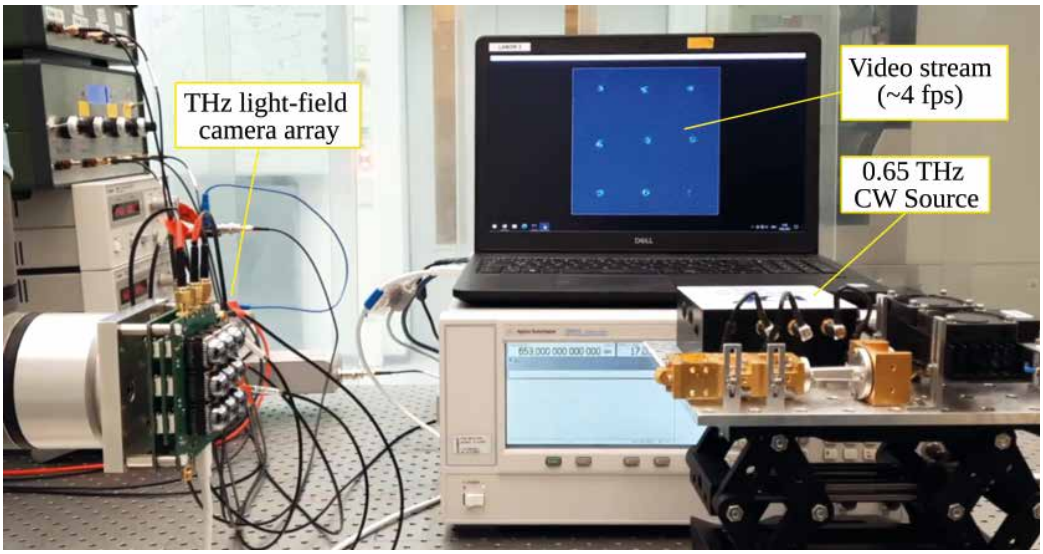
Why perform Terahertz LF imaging?

The terahertz frequency (wavelength) range, defined between 300GHz (1mm) – 3THz (0.1mm), offers unique advantages for imaging and sensing applications. As compared to the lower frequency microwaves or millimeter-waves (mm-wave), terahertz waves offer a finer, sub-mm scale image resolution comparable to a human eye which is good enough to resolve shapes of most common objects in everyday life. Terahertz waves are strongly absorbed by water molecules, reflected by metals, and transparent to the dielectric materials such as daily use plastics very similar to x-rays. However, the X-rays possess large energy photons which can cause ionization of biomolecules such as the human genetic structures, and therefore X-ray doses must be limited and shielded to prevent unintentional exposure. Comparatively, THz waves do not come with such side-effects, and they can be operated freely. As a result, THz imaging exhibit strong potential in security screening, package inspection, quality control, biomedical diagnosis, and art conservation. Until recently, the attention is focused towards performing traditionally 2D imaging due to the limitations of the THz hardware components. The state-of-the-art THz transmitters and receivers are either weak in performance or lack sufficient integrability to be implemented in sophisticated computational imaging techniques such as Light-field Imaging.

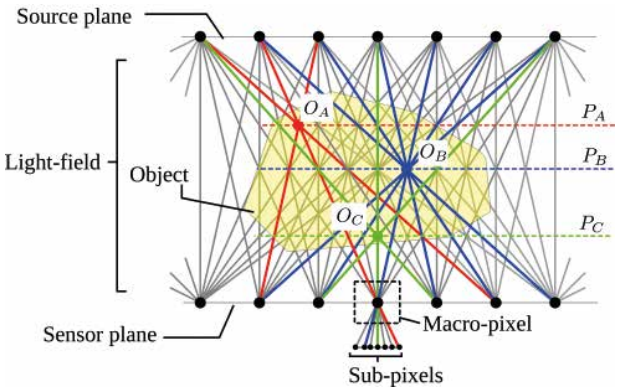
Light-field (LF) imaging is a robust computational technique based on ray-tracing geometry for 3D scene reconstruction, depth estimation and content editing. Here, the light flowing into and out of the object is considered as a vector field composed of ray bundles, which are quantified in terms of the energy density along a specified direction and position in the 3D space. If the position and flow direction of individual light rays are known, either back-propagation (from the sensor) or forward propagation (from the source) can be applied to reconstruct a 3D volume source of the field disturbance. The light-field method works with incoherent radiation, but it requires spatio-directional sources and detectors, i. e. components which can synthesize and sample the light along multiple angles across different spatial locations. Isotropic, incoherent sources are excellent at generating spatio-directional light-fields that can be readily sampled by a camera. Light-field techniques have become really popular for visible light imaging due to the ubiquitous availability of such sources and inexpensive cameras.

How Light-Field Imaging Works

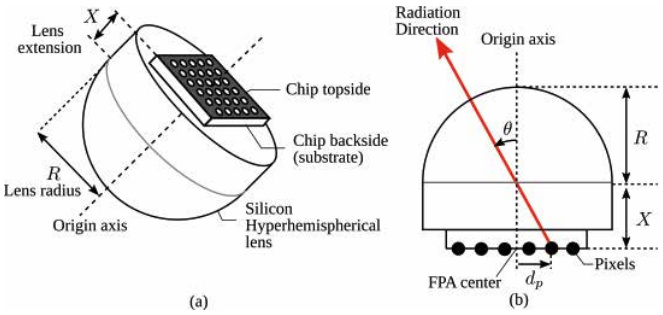
The fundamental idea behind light-field imaging is to map the space between two planes, one classified as the source plane and other classified as the sensor plane based on the direction of energy flow, as the vector fields. Such representation may encompass one subspace of a full light-field system which might also consist of other components such as lenses and mirrors. It is assumed that the sources and sensors are isotropic, i. e. they radiate and capture energy respectively along all directions. Assuming that there are no wave effects (diffraction and interference), the straight lines joining the sources and the sensors form the light-rays. An object placed between the two planes will partially transmit and partially reflect thus perturbing the light-field. If all the



THz light-field camera array in operation showing the mapped radiation pattern of a 650 GHz source.



Spatio-directional light-fields between source and sensor plane containing macro-pixel and sub-pixel arrangement.



Sketch of silicon-lens (macro-pixel) and THz focal plane array of direct detectors (sub-pixel).

spatio-directional light-rays can be sampled at the sensor plane, ray-tracing, and integration of light intensity along different sets of rays in post-processing can allow focusing on different parts of the object (including its depth axis). The concept can be extended to multiple sets of rays to acquire 2D images corresponding to planes different planes in the scene forming cross-sections along the object depth, leading to a 3D reconstruction.

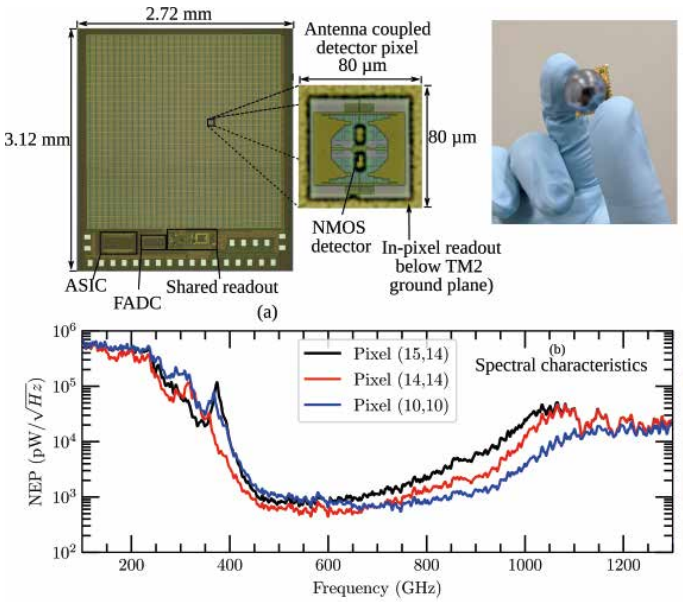
How do we sample the light-field? If each point on the sensor plane is a single pixel, all the light rays captured within this pixel are integrated in intensity, and the spatio-directional information is irrevocably lost. Instead, multiple sub-pixels are required at each sensor position (macro-pixel) to sample the incident light along different directions. This macro-pixel is the key building block for any light-field imaging system. The object sampling density corresponds to the discretization of the light-field, which is associated with the spatial and angular arrangement of the sub-pixels and the macro-pixels.

Light-Field Imaging at Visible vs Terahertz Wavelengths

The first demonstrations were based on scanning a scene by moving a single camera, for applications such as modelling of a 3D illumination source, virtual imaging illustration, digital archiving of renaissance art sculptures, and the interactive city panoramas. Compact light-field camera designs have been demonstrated, consisting of a 2Darray of micro-lenslets arranged over a digital camera sensor. This technology is now commercialized for 3D imaging and computational aperture synthesis in photography and 3D microscopy. Some of these advancements have led to the multi-camera setups available widely in modern day smartphones.

There are many similarities between the visible light and the incoherent THz light-field systems. Both require spatio-directional sensors and diffused illumination. The plenoptic function for both is real valued and the intensity drops by $1/r^2$ for a distance r away from a point source for a spherical wavefront in the far-field. However, there are also significant differences between THz and visible light presenting unique challenges for THz light-field systems.

First, the wavelength at THz is nearly three orders of magnitude larger than the visible light. This



(a) Micrograph (left) and packaged view (right) of fully integrated Terahertz digital camera with 32 x 32 pixels (with individual antenna-coupled detector highlighted), (b) broadband spectral characteristics of few selected antenna-coupled detectors.

All Images: Uni Wuppertal

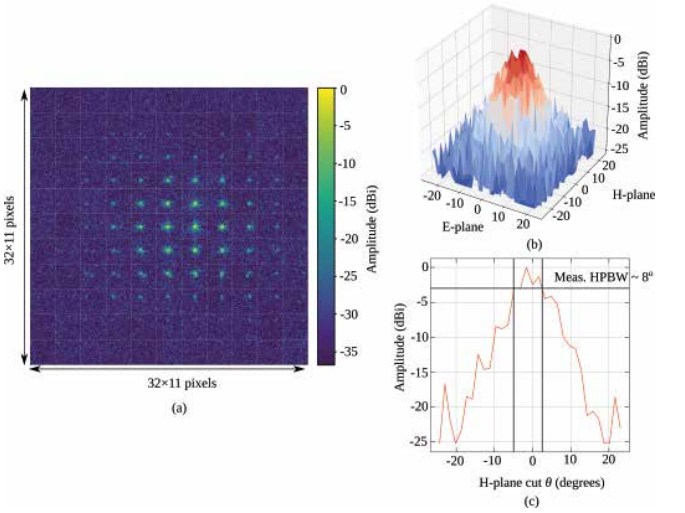
severely limits the dense packaging of the sensing pixels due to larger scale diffraction limits. Also, high intensity isotropic incoherent THz sources do not exist so far. It is not possible to do computational light-field imaging in the absence of appropriate illumination. The same is also true for THz sensors. Another particularly important challenge at THz is the low integration density, as only a few hundreds of THz sensors can be integrated within a focal-plane array (FPA) as compared to visible light sensors with millions of pixels. This directly limits the light-field density and the achievable image resolution. The lens-arrays that are required to capture the spatio-directional light-field in compact cameras are also not available at THz frequencies.

Capturing Spatio-Directional Light-Field Diversity in a Multi-Chip Terahertz Camera SoC?

The preliminary requirement for performing LF imaging is to have large focal plane arrays (FPA) of detectors capable of resolving spatio-directional diverse light-fields. Could a fully integrated THz digital camera comprising of 2D arrays of antenna-coupled CMOS direct detectors coupled to a high-resistivity hyper-hemispherical silicon lens be implemented to capture spatio-directional light-fields?

In silicon lens-integrated THz FPA configuration, the antennas radiate from the backside (toward the substrate) of the chip. The extension length of this lens is selected such that the pixel-array is located at the focal point of an approximate ellipse formed by the hyper-hemispherical lens. This allows for pixel to angle mapping implying that spatial location of a pixel on the array corresponds directly to the receive beam angles. The mapping is deterministic, and it can be predicted to the first order with a pinhole image formation mode. In effect, the silicon lens plays the role of a macropixel and the 2D arrays of detector pixels play the role of a subpixel providing directional diversity. A fully integrated THz Light-field subpixel consists of 32 x 32 antenna-coupled CMOS THz power detectors. These detectors exhibit broadband spectral characteristics with best operating frequency at 600 GHz and a 3dB bandwidth of nearly 300 GHz. The detectors are activated in a rolling shutter mode through an on-chip row and column selection logic, and the programmable gate arrays, correlated double sampler (CDS) for offset cancellation and ADC are globally shared across all detectors.

A full-fledged THz light-field camera SoC is realized by implementing large arrays of such macropixels and routing the control logics on a common motherboard. Such multi-chip scaling approach is a convenient way of keeping fabrication costs under check along with retaining the advanced functionality of fully integrated THz digital cameras. Having modular design permits to flexibly scale the THz light-field imaging system and individual CMOS THz digital cameras can be replaced conveniently.



(a) Raw light-field image data. (b) Reconstructed source antenna pattern and (c) Cross-section of the light-field reconstructed antenna pattern.

An Example of 3D Reconstruction

The THz light-field camera was used for a real-time imaging demonstration. The camera was placed in front of a 650 GHz CW AMC source, and the light-field image data was streamed out in form of a video at an overall framerate of 4 fps with each sub-camera streaming at 36fps. The imaging speed was limited by the controlled implementation – individual commands were sent in sequence from a python interface to trigger the data acquisition from each camera. For purely demonstration purpose, the 3x3 array of THz light-field camera was stepped in 2D to capture the light-fields of a diverging source. The spatio-directional data collected are then computationally processed to reconstruct the radiation pattern of the AMC source.

A multi-chip scaling approach is a convenient way of keeping fabrication costs under check along with retaining the advanced functionality of fully integrated THz digital cameras.»

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Image: Teledyne Dalsa

Portfolio Expanded with 10GigE Cameras

Teledyne Dalsa has introduced the Genie Nano-10GigE M/C8200 and M/C6200 cameras, based on Teledyne e2v's 67M and 37M monochrome and color sensors. The series consists of small 10GigE Vision cameras that enable full-resolution image transmission at up to 15 frames per second. Both the M/C8200 and M/C6200 offer a wider operating temperature range, PTP synchronization and the same physical size as other Genie nano cameras, allowing for use in a wide range of applications and easy integration or upgrade. The 59 x 59 mm form factor allows system designers to transition from 1, 2.5 and 5GigE to 10GigE vision without requiring any software changes. The Genie Nano 10GigE cameras are designed for applications such as electronics manufacturing inspections, industrial metrology, and intelligent transportation systems.

www.teledynedalsa.com

Image: Fraunhofer IOF

Coating Against Unwanted Reflections

Optics that do not fog up and hardly reflect – this will be possible in the future thanks to a new optical coating system. The technology developed by researchers at the Fraunhofer Institute for Applied Optics and Precision Engineering IOF is intended to help improve the performance of Lidar systems and cameras in autonomous cars, for example. The innovative optical layer system combines a polymer coating with porous silicon dioxide nanostructures. The polymer coating prevents fogging, while the nanostructures reduce reflections at the same time. Although the coatings are specifically designed for Lidar systems, the technology can be tailored for many different applications.

iof.fraunhofer.de

Image: Emergent

Quad-Port Network Interface Cards

Emergent Vision Technologies introduces the 25GigE Hermes PH-25-QUAD and 10GigE Theia PT-10-QUAD network interface cards (NICs), which enable customers to get the most out of their Emergent ultra-high-speed cameras for a wide range of machine vision and imaging applications.

Both quad-port PCIe Gen3 x16 smart NICs feature a real-time, front-panel 5V TTL trigger input for additional flexibility and support for GigE Vision Streaming Protocol (GVSP), Windows and Linux operating systems, GPUDirect, and camera multiplexing with switches. The PH-25-QUAD and PT-10-QUAD are not limited to a single video stream but can handle multiple streams depending on the device's resources.

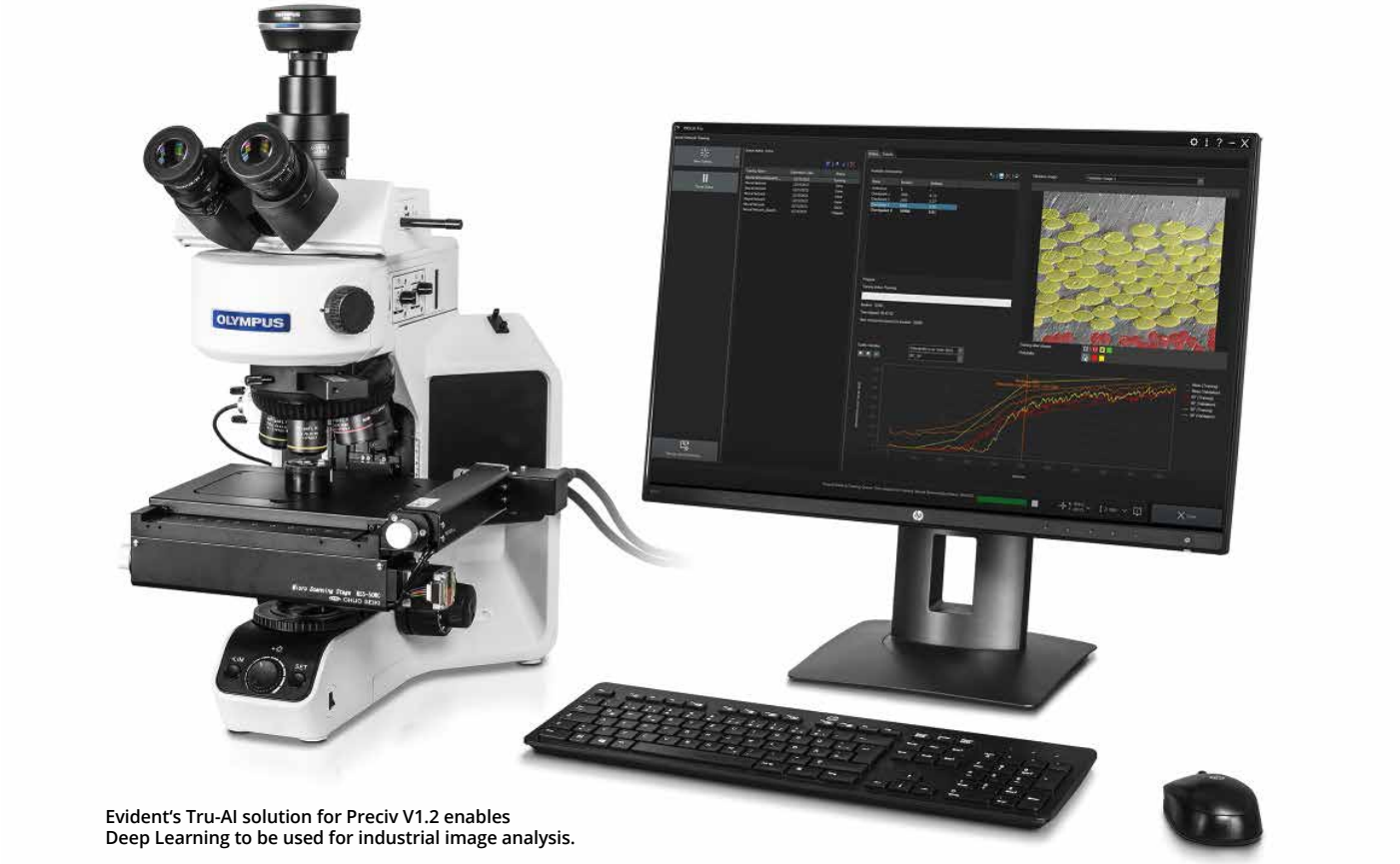
www.emergentvisiontec.com

Image: Cincoze

Embedded Computer for Vision-Guided Robots

Cincoze has introduced the DS-1300 series, a workstation performance and PCIe expandable embedded computer. Since its launch, it has been used in VGRs for material picking, product assembly, machine operation, welding, and stacking. The series supports a 10th generation Intel Xeon/Core CPU, up to 64 GB of memory, and an M.2 NVMe slot that can satisfy the VGR requirements for visual data collection, processing, and analysis. The DS-1300 supports up to two sets of PCI/PCIe expansion slots, enabling the connection of various commercially available high-speed I/O cards, image capture cards, motion cards, or GPU cards for image analysis or robot control. The adjustable PCIe card retainer holds the expansion card securely in place, even in a high-vibration environment.

ww.cincoze.com



Evident's Tru-AI solution for Preciv V1.2 enables Deep Learning to be used for industrial image analysis.

AI-Supported Microstructure Analyses in Metallography

Automated Material Analysis Using Neural Networks

Analyzing metallographic images with manageable effort is possible with the use of artificial intelligence, especially when it comes to distinguishing between grain boundaries and grinding marks, for example. A microscope manufacturer explains how such a neural network is constructed and used.

Conventional threshold-based analyses are carried out as a standard method in digital image processing. These analyses are often specified as a requirement in standards for the microstructure analysis of metals, alloys, ceramics, composites, and other materials. While it is an established method, image thresholding has some limitations.

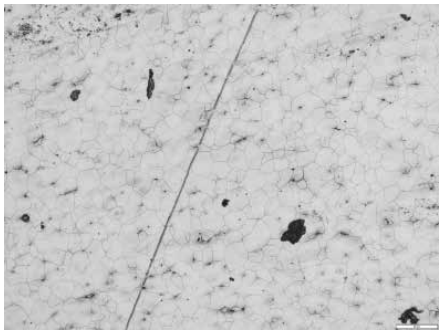
Thresholding does not detect specific structures in the images. It detects multiple objects at once without distinguishing between them. Analytical algorithms such as thresholding can use additional approaches, such as edge enhancement filters, shading correction, and morphological analyses, to find specific structures. However, these approaches require programming skills and effort to enable automated analyses. Further, some problems may not be solvable with these approaches, taking into account the potentially huge number of special cases and exceptions.[1] In contrast, machine learning forms rules for object detection based on multiple examples of representatives of objects of interest.

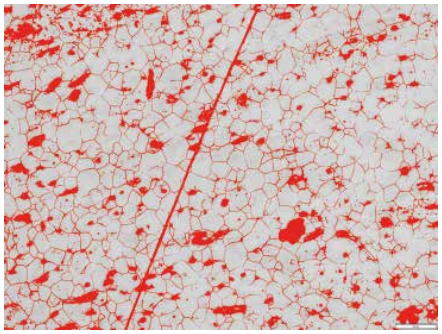
Applying AI-Assisted Image Analysis to Metallography and Materialography

Image analysis assisted by artificial intelligence (AI) promises to solve many of the issues associated with analytical approaches. Automated evaluation, supported by deep artificial neural networks that have learned to classify image areas independently of previously set threshold values in the image, opens a new world of easier and more accurate image analysis. In metallography and materialography laboratories, AI-assisted image analysis revolutionizes everyday work.

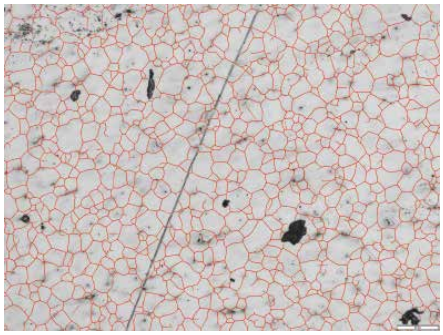
The differences between the threshold method and an automated evaluation with AI is shown when we look at a metallographic sample with grain boundaries, polishing marks, and dust. With the simple threshold setting, the image analysis software cannot clearly distinguish the grain boundaries from the polishing marks and dust. This results in an incorrect grain size measurement since it is impossible to detect only the grain boundaries.

With the assistance of AI, traces of grinding, polishing, dust, and residues can be distinguished from objects of interest, such as grain boundaries, in images of polished sections. AI-assisted image analysis can detect grain boundaries in microstructures that have very inhomogeneous grain structures with reliability and reproducibility. In addition, structural components can be classified with pixel accuracy.





Left: A metallographic sample with grain boundaries, polishing marks, and dust. Right: The same image, but with highlighting using the threshold method. Here, grain boundaries cannot be distinguished from polishing marks or dust.



Again, the metallographic sample with grain boundaries, polishing marks and dust, this time analysed by Deep Learning. Here, the grain boundaries (red) can be clearly recognized and distinguished from polishing marks and dust.

The Standard Workflow for AI-Assisted Microstructure Analysis

Supervised learning, as a subfield of machine learning, is a term for methods designed to predict or classify an outcome of interest. With these methods, labels are used to clearly specify which features the learning model should detect.[2, 3] The resulting algorithm is based on the labeled data. Care must be taken so the algorithm does not fit the training data too closely. Otherwise, the algorithm may correctly detect objects in the training data but fail to perform with the same quality on new data.

For deep-learning-based image analysis, the labeling of data requires creating images with "ground truth," the information with which the neural network is trained and evaluated.[4] This information must be marked in the images through image processing or hand labeling.

Further, the verification of the training data by specialists is essential. Only a specialist can define which data should be used for the training as it is the source the trained neural network uses for the analysis. The specialists must be experts in the material analysis application so they can make decisions about which details in the image should be detected.

Using the example of a metallographic section, the specialist might ask: When is the feature considered a grain boundary? How do we evaluate abnormalities? Importantly, the data must be representative of all expected objects and mappings within each class.

After this first phase, the second step is to select the optimal training configuration for the task. This is done using instructions for augmenting the training data[5] and selecting the training model. Augmenting the training data supports the training by giving the neural network model significantly more opportunities to learn and increase its reliability. The training data is multiplied by rotation, mirroring, and other image operations. It is important to note which augmentation method makes sense for the specific application. For example, rotation is useful for structures with no preferred direction but not useful for elongated materials such as rolled materials.

In deep learning, an artificial neural network with a given structure is created, but the decision-making process that the network uses is hidden. The network does not provide any analytical justification as to why a decision is made.

However, a specialist can validate the training success by seeing if the results from an analysis fit the expectations. It is possible to use validation data sets to compare how well the trained artificial neural network can recognize the specified image areas. The network can be used to generate a probability map which can be displayed during training on labeled validation images as an overlay. The validation data are not part of the data set that was used to train the network. To achieve a realistic assessment of the training status, the similarity between quality criteria, such as loss, evaluated on the training images and the validation images can be output numerically, and as a graph.

After a training that includes validation has been performed, a new data set is used to check whether the algorithm still works on representative new data: the test data set. This final test must be verified by a specialist, or ideally by multiple experts, to reduce the risk of misinterpretations of AI results due to human bias.[6]

The trained neural network is now available as a segmentation method that can be applied to comparable images, such as images with similar light and exposure conditions. Applying a properly trained neural network can be realized easily and efficiently. With a single click, the network automatically segments the image and delivers reproducible results.

Conclusion

With manageable effort from a specialist, it is possible to use supervised deep learning in metallographic and materialographic image analysis for clearly defined tasks, such as image classification, object detection, and image segmentation. A specialist is essential for validating the marking of the ground truth in the training images, the test data set, and for checking the final evaluation test. Provided that the artificial neural network is well trained, AI offers powerful, reproducible image analysis on comparable images.

To learn more about the benefits of AI in microstructure analysis, go to olympus-ims.com/ landing/truai-technology. ■

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Cameras Ensure Perfectly Placed Heat Sinks

Quality Assurance in Electronics

In an inspection system for the electronics industry, CMOS cameras ensure that heat-conducting pads bonded to an aluminum heat sink are present and have been perfectly positioned at the intended position.

The electronics industry is one of the key international industries and in many cases, it is the performance of its products that creates the basis for the functioning of many machines, systems and devices. Economical solutions are only possible if the quality of produced electronic components meets the specifications by 100 percent.

For various reasons, however, the quality control of electronic components can be tricky: The features to be inspected are often very small, the components are produced in high volumes, and they usually have to be inspected at relatively high speeds for reasons of production effectiveness. From an image processing point of view, this is further complicated by the fact that electronic components often at least partly consist of metallic components which, due to light reflections, can only be reliably inspected for defects by using optimally designed illumination and image processing systems.

Inspection System Checks Exact Placement of a Heat Conduction Pad

Malaysia-based company Rimburgs is a specialist in automation customisation for machineries and equipment and has gained great experience over many years in the optimal design of inspection systems for the electronics industry. In a recent project, the company implemented an inspection system for a customer to verify that a thermal pad previously placed on an aluminum heat sink and attached with adhesive was present and applied at the intended position.

"Our customer wanted to check and accurately measure the position of the thermal pad on an aluminum plate," explains Sow Jing Zhi, Technical Support Engineer at Rimburgs. "If the thermal pad is outside the placement tolerance of 0.5 mm or has an angular deviation of more than 5 degrees, the produced part will be rejected. This error can occur, among other things, if the adhesive was not metered correctly or the heat-conducting pad was not fed optimally for placement."

For building a fully automated and effective solution, it was clear to the developers at Rimburgs from the very beginning that this task could only be solved with the help of a suitable image processing system. The company had already realized numerous other projects in the past in which it had relied on industrial cameras from the Danish manufacturer JAI with consistently positive experiences, says Sow: "We were very satisfied with

A fully automated system developed by Rimburgs ensures that thermal pads bonded to an aluminum heat sink are present and have been positioned in the intended location.

Image: Rimburgs

JAI's Go-X series CMOS cameras are critical components for the system designed by Rimburgs. They are available in many models with different resolutions and interfaces.

Image: JAI

The camera's correction features give the user confidence that the accurate, centered position of the thermal pad on the aluminum plate can be correctly determined.»

the quality of the JAI cameras and therefore decided to work with them for this project", added Sow.

5 Megapixels with Shading and Color Correction

To check the position of the heat-conducting pads in this application, Rimburgs opted for a Go-X-5103C-PGE CMOS color camera from JAI, which, with a resolution of 5 megapixels and a global shutter, was able to deliver the required image quality.

The camera is installed at a working distance of 140 mm above the test object, and a diffuse ring light with a diameter of 130 mm as well as a C-mount lens suitable for megapixel cameras were used to ensure optimum image quality during image acquisition.

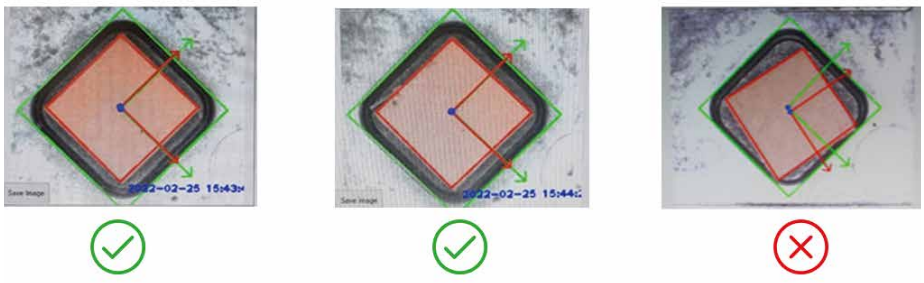
However, in addition to the high resolution and global shutter, there were other reasons why Rimburgs developers chose the JAI Go-X-5103C-PGE, underlines Sow: "Due to the mechanical structure, the captured images are inverted in the top view, so image inversion was required to ensure that the image could be correctly displayed. This camera provides that capability, as well as the necessary shading and color correction." The JAI camera's image sensor has color filters over the pixels in a standard Bayer RGB filter pattern. An algorithm on the host computer interpolates this information to produce color images, though the colors may vary a bit from the actual colors due to the estimations made by the interpolation routine. This is easily compensated by using the camera's shading and color correction functions to ensure that the images are displayed realistically.

These correction features of the JAI Go-X-5103C-PGE also give the user additional confidence that the accurate, centered position of the thermal pad on the aluminum plate can be correctly determined. "Material variations of the aluminum can lead to high contrast differences on the aluminum surfaces, making it difficult to detect the specified position of the thermal pad. The JAI camera's proven shading and color correction minimizes this source of error," says Sow.

Camera Series with Multiple Interfaces

The fact that Rimburgs has chosen JAI as its image processing supplier for this application is due not only to the technical features of the cameras, but also to the renowned quality of products manufactured in Japan, emphasizes the Rimburgs Technical Support Engineer. "A product manufactured with Japanese quality and technology gives our customers the necessary confidence, which is also underpinned by the six-year warranty that JAI gives on its cameras. This long period is unique in the image processing industry and was another important reason for us to choose JAI cameras."

The Rimburgs-designed inspection system uses Go-X models with a GigE interface, but this camera series from JAI is not limited to that: Only recently, the Danish manufacturer introduced 24 new models, some of which are equipped with a CoaXPress 2.0 interface. Models of this series with USB3 Vision interface are also already available. 12 further Go-X versions with 5GigE (5GBASE-T) have already been announced. With a resolution range from 2.3 to 24.5 megapixels in monochrome and color, the JAI Go-X camera series thus offers a high degree of flexibility for many applications, both within and outside the electronics industry. ■



The thermal pads must be positioned with a maximum tolerance of 0.5 mm and an angular deviation of less than 5 degrees.

Image: Rimburgs

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(UV-) A, B, C - Easy as 1, 2, 3

The Challenges of UV Imaging

The new UV camera can detect UV radiation with very high sensitivity and delivers undistorted images of fast-moving object applications with high framerates while special UV optics lead to extraordinary spectral sensitivity.

While the human eye (human sensitivity) is limited/restricted to the spectral range of 400-750 nm, many animal species such as bats, fishes, and certain insects (e. g. bees) use an extended spectral sensitivity to scan, sense, and classify their environment. Here, extended sensitivity in the UV range is essential for survival.

Meeting highest standards

In contrary, humans still rely physiologically on the visual inspection using visible light (VIS) for process control, inspection, and quality assurance. Accordingly, in many cases the identification of product anomalies/-defects such as scratches, holes, or just small uneven surfaces is performed by computational power and integration of complex algorithms for classification and training using neuronal networks (i. e., artificial intelligence) with criteria derived from the human perception.

Nowadays products as well as the overall production pipelines have to fulfil even higher standards concerning throughput, traceability, and quality assurance, setting new requirements on the camera systems in terms of temporal resolution and latency for product-anomaly detection in real-time. To avoid the necessity of implementation of complex search and classification algorithms, which are fundamentally required in the VIS range, changing the illumination into UV finally leads to a material-specific absorption behavior, enabling easier distinguishable small product-defects and anomalies from functional areas (higher contrast).

Placed at the lower end of the electromagnetic spectrum, UV closes the gap between the X-ray and the visible spectrum. As the most energy-containing radiation of sunlight, UV radiation is classified into three major classes (UV-A, UV-B, and UV-C). While UV-C contains the highest energy covering a spectral range of 100 to 280 nm, UV-B covers 280 to 315 nm followed by UV-A with 315 to 380 nm, closing the gap to the visible spectrum.

Producing UV-optics

While UV-C is known to be the most cancerogenic radiation, leading to irreversible DNA damage, its low penetration depth as well as the strong material-specific absorption behavior offers a broad range of possible applications. Exactly this high degree of absorptivity of UV by carbon-, nitrogen- and water molecules (as main ingredients of the human body), makes it highly attractive for academic research, medical instrumentation, and industrial applications (see application section for details).

However, due to the increased absorption and optical scattering with decreasing wavelength, UV-optics (lenses) cannot be fabricated as easily when compared to VIS and IR lenses. Thus, smallest optical surface inhomogeneities (such as blemishes, contaminations, and errors) cause a significant scattering, leading to reduced product quality and fabrication system throughput. Furthermore, scattering of light can result in energy loss, poorer efficiency of the optical system, and false signals in applications with image sensors or other detectors. Moreover, intense UV light causes bleaching of the substrate, change of chemical properties, and can lead to the destruction of the optical material itself.

By using the newest 8.1 Mpix Sony IMX487 CMOS sensor, the camera's spectral range is extended from NIR, and VIS, into the deeper UV regime covering a maximal range from 200 to 1000 nm.

Ximea's new UV camera has extraordinary spectral sensitivity for UV-A, UV-B, and UV-C.

To account for such optical effects, UV-specific optical materials have a greater dispersion than those for visible or IR light and lead to significant aberrations in broadband UV applications. Thus, many optical UV systems contain refractive optics that prevent dispersion within the material as well as UV substrates that must transmit the entire desired wavelength range and be almost perfectly polished. Common UV-transmitting substrates such as quartz glass, calcium fluoride, sapphire, and borosilicate, can provide these high characteristic material demands and have a significantly reduced probability of multiphoton-absorption.

Besides these optical material challenges the UV imaging system has to offer a sensor capable of capturing the relevant spectrum with a high spatial and temporal resolution. Leveraging the potential of the Sony IMX487 Ximea is expanding the UV camera portfolio with the MX081UX-SY-X2G2 camera model to fill the void.

Technical aspects

Aiming to detect UV-A, UV-B, and UV-C radiation, this camera is specially designed to operate under low-light conditions, where an extended UV sensitivity as well as high-speed is highly required. Moreover, this camera has to fit into spatially restricted areas (tight conditions) and work properly under strenuous environmental conditions with a high demand for precision and repeatability such as required for e. g. optical microscopy system, inline product inspection, and quality assurance in general.

To fulfil these requirements Ximea's latest UV camera, MX081UX-SY-X2G2, is based on the long-term established xiX camera series with a PCI Express Gen2 Interface (-X2G2). By using the newest 8.1 Mpix Sony IMX487 CMOS sensor, the spectral range is extended from NIR, and VIS, into the deeper UV regime covering a maximal range from 200 to 1000 nm. Due to the backside illuminated sensor architecture (BSI), the sensor can detect UV radiation with even higher sensitivity. Combined with Sony's Pregius S global shutter pixel technology, this sensor enables to delivery of undistorted images even of fast-moving object applications with high framerates. Besides, the sensor architecture itself, specialized UV optics/glasses (quartz glasses with high UV transmittance) are utilized covering the image sensor and focusing UV light on the chip, leading to an extraordinary spectral sensitivity (QE >20 percent) in the high-energy UV range.

Besides, its expanded spectral UV sensitivity and high spatiotemporal resolution, a remarkable feature of our new camera is still its compact dimensionality (26/26/31 mm (h/w/d) with a total weight of 30 g, this camera design matches nearly all instrumental conditions, enabling improved detection in a wide, versatile range of scientific and industrial applications. To ensure the highest contrast and best image quality, a high-precision UV lens/optics extended with an optical filter should be added/used in front of the camera.

Crucial camera electronics

In addition to suitable optics, the overall system also requires a camera electronics in order to quantify the optical information and transfer it to the host at least. Here, Ximea utilizes the I/O-sensor interfaces available as to variants. While the SLVS (4/8 channel) provides a maximal output up to 297 Mbps per channel, using SLVS-EC (1/2/4/8 lanes) leads to 1.188 Gbps per lane, respectively. According to the used I/O interface, Ximea offers two XIX models version interfacing PCIe Gen2 x2 lanes (10 Gbits/s) and PCIe Gen3 x4 lanes (32 Gbits/s), enabling framerates of 59 fps and 194 fps, respectively.

As usual for all Ximea camera models, the MX081UX-SY-X2G2 also supports multiple vision libraries and tools (i.e., Mathworks Matlab, Python, Open CV, Micromanager, Labview), therefore allowing for an easy handling, control, and system integration.

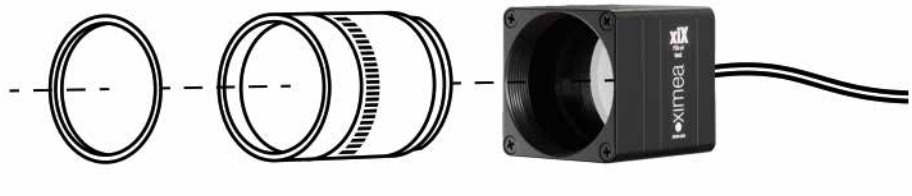
Application

The wide pool of possible applications for this detector ranges from research, over industrial to life science applications. Industry, specifically the mass production of semiconductors (flaw inspection) and printing inspection, pushes more and more into the high spatiotemporal regime, requesting higher throughput and distinguishability of individual components. Moreover, striving for more sustainability, especially in the recycling industry, mainly demands new camera technologies with expanded UV sensitivity. Thus, enabling the distinction of more materials such as VIS-transparent plastics (Polyethylene, PET) by differentiation based on material- specific absorption.

Besides the inorganic UV applications, many biologically relevant molecules/ organic molecules such as flavonoids, coumarin, and phenol (secondary plant metabolite), highly associated with cellular stress, have spectral signatures in the UV. Utilizing UV-sensitive cameras, allows us to study and characterize the growth behavior of plants under harsh environmental conditions such as droughts and floods. Thus, they can be used to fight against famine.

Following the latest trends in life science, specific spectroscopy techniques including UV absorption spectroscopic imaging techniques such as UV/VIS- and UV-Raman spectroscopy/imaging, significantly benefit from this extraordinary UV-sensitivity, expanding the scientific usage into many fields such as forensic, plant science, astronomy, and atmospheric chemistry.

Finally, besides the common trends, the electric infrastructure might significantly benefit from this UV sensitivity. Here, high-voltage power lines (length >10 km) are of major importance for electricity infrastructure companies. Identifying defaults in the early stage as well as enlarging the diagnosis capacity by implementing efficient inspection processes are required to ensure 24/7 power grid reliability. In specific, defaults such as "Corona discharges" (causing ionization of the air surrounding a high-voltage conductor) produce a UV-glowing plasma, which generally occurs at defective points of the conductor. Since corona discharges indicate unstable/defect points within the electrical infrastructure, cameras suitable to detect these defects significantly increase the overall efficiency of such electric systems.



Compact arrangement of Ximea UV camera, schematically extended by UV optic and UV shortpass along the optical axis (dashed line).

Outlook

Following the latest trends, Ximea will significantly advance the development of its UV-sensitive cameras in terms of expanding the sensor diversity, modified mechanics (cabling, form factors, etc.), and the latest state-of-art interfaces. As a technology-driven company, Ximea can react fast and flexibly to the current market situation and can provide customized camera solutions fulfilling all demands from clients in fundamental science and industrial applications. ■

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Images: Ximea

Real 3D From a Single Source

Powerful 3D Package for All 3D Sensors and Numerous Industrial Applications

A new, high-performance 3D sensor generation features software which provides real 3D evaluations and is compatible with a complete range of sensors.

To achieve highly accurate 3D measurements, a perfect match of hardware and software is required. Sensor specialist Micro-Epsilon has taken this into account in the development of the new 3D sensor generation and therefore not only relies on powerful hardware, but also supplies the perfectly matched 3D Inspect software to go with it. This means that all of the manufacturer's 3D sensors can be operated with uniform software. It is is compatible with surface control sensors for geometry, shape, and surface inspections of matt objects, reflect control for measurement and inspection of glossy surfaces, and 3D laser scanners for precise inline 3D measurements. The 3D Inspect software enables real 3D evaluations and not just 2.5D as with conventional software. This means that each x-y coordinate has several z-coordinates available. In addition, sensors and software come from a single source, which means that only one contact person is needed to solve complex measurement tasks.

Powerful Software for 3D Point Clouds

3D Inspect is designed for ease of use and offers intuitive operation. The software enables the parameter setting of the sensors, but also the acquisition of the measurement data. The tool palette is versatile and ranges from the alignment of point clouds and the selection of relevant objects, to filters for smoothing and optimizing the point cloud. Calculation programs for distance, height, angle and radius are also already integrated. The determined data can be easily output to the PLC but can also be further processed as desired. In addition to the standard version, the "Automation" function extension supports automated production processes. Video tutorials easily explain the software application and its features. Another benefit: the software is constantly being developed, so is always up to date and every new release offers further useful functions. A comprehensive SDK is available for third-party and custom image processing solutions. This is based on the industry standards GigE Vision and GenICam including numerous function blocks. A C/ C++/ C# library with numerous sample programs and documentation supports software development.

Extensive Software Functions at a Glance

The measurement programs can be divided into three groups. The „Data processing" to which the point cloud selection, filtering, transformation, and alignment programs belong. Here, among other things, corrections of the position, point selection, alignment based on cuboids, planes, lines, or points are possible. But also average, median, low-pass, high-pass and erosion filters are included.

The "Objects" group contains programs for fitting geometrical objects. Here, for

The 3D Inspect software provides real 3D evaluations and is also compatible with all Micro-Epsilon 3D sensors.

example, centers of gravity or extreme points in the 3D point cloud can be calculated. Fitting of objects such as spheres or cylinders into the point cloud is also possible for further evaluation.

Under "Combine objects" you will find programs that relate previously found objects to each other. This process is based on various calculations such as distance, angle, or center point between two objects.

In "Outputs and Results" the measurement results can be mathematically combined and calculated, and detailed options

The reflect control systems are used, among other things, in the semiconductor industry, for example for 3D shape detection of wafers. They check the flatness or planarity of wafers with only one shot.

for signal output are available. Available output formats are UDP, TCP, Modbus, where 3D Inspect acts as the server. With additional modules, control and measured value output are also possible via Profinet and Ethernet/IP.

3D Measurement of Diffusely Reflecting Surfaces

The comprehensive 3D software package from Micro-Epsilon is also compatible with the surface control sensors. They are used for fast 3D measurements and inspection of diffusely reflecting surfaces such as metals, plastics, or ceramics. The sensor uses fringe light projection, which can be used to detect diffusely reflecting objects, and calculates a highly accurate 3D point cloud from the acquired data. Based on the point cloud, it is possible to detect geometries and the smallest of defects. Even the finest structures on components and deviations in shape become visible. Sensors with different measurement areas and performance data are available. Since the sensor is extremely slim, it can also be integrated into restricted installation spaces. The special feature of these systems is the combination of automatic surface inspection, highest precision from 0.4 µm, as well as fast and extremely reliable detection of a wide variety of object and surface geometries.

3D Measurement of Shiny Surfaces

The reflect control sensor is designed for 3D measurements on shiny and glossy surfaces. The sensor is suitable for stationary use in micrometer-accurate measurements when monitoring the production line, or for inline inspection on a robot. A fringe pattern is generated on the sensor display, which is mirrored across the surface of the target into the sensor's cameras. Deviations on the surface cause distortions of this striped pattern, which are evaluated by the software.

3D Laser Scanners for Inline Quality Inspection

Scan control laser scanners are among the most powerful profile sensors worldwide in terms of their accuracy and measuring rate. In order to generate 3D scans the sensors must move. Either a robot or traversing system moves the scanners over the measuring object, or the measuring objects are guided past the scanner on a conveyor belt. Micro-Epsilon's laser scanners offer a unique combination of high dynamism, precision and compactness. The sensor specialist offers a comprehensive portfolio with numerous measuring ranges, Red and Blue Laser technologies and extensive accessories. The scanners are equally convincing for system integrators and for series use in the production line. They can be optimally integrated into image processing software packages via the Ethernet/GigE vision interface.

«

Numerous 3D measurement tasks can now be solved efficiently and with measuring systems from a single source.»

Conclusion

The special feature of Micro-Epsilon's innovative 3D complete package is 3D Inspect, a powerful and at the same time very easy-to-use 3D software that is compatible with the entire range of 3D sensors. This allows numerous 3D measurement tasks to be solved efficiently and with measuring systems from a single source. The sensors are flexible and provide real 3D evaluations for diffuse-reflective, glossy and many other surface types. Measured values are output via UDP, TCP, Modbus, Ethernet/IP, as well as Profinet. For evaluation, the manufacturer offers in-house test measurements as well as rental equipment. ■

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Images: Micro-Epsilon

The ignition coils are examined in a stationary manner with a dwell time of less than one second.

Flawless Ignition Coils for the Automotive Industry

Intelligent Vision Systems Automate the Inspection Process, thus Saving Time

With Custom factory automation systems and machine vision, U.S. machine builder Steven Douglas Corp. ensures that automotive ignition coils are manufactured effectively and meet all quality requirements.

Automotive manufacturing is a wholly globalized industry. Companies of every size and niche are competing with one another on a massive scale. Only those who keep costs and delivery times at a low level without sacrificing quality and throughput have a chance of succeeding in this highly competitive market. Manufacturers and automotive suppliers must therefore find new, innovative ways to prevail in the market.

Finding ways to reduce production time and cost comes naturally to Steven Douglas Corp. (SDC), an Ohio-based company that engineers, designs, and builds custom factory automation systems. When an automotive component manufacturer approached SDC to design an automated system for assembling ignition coils, SDC knew the vision system would be the solution's foundation.

Three Vision Systems

Manufacturing ignition coils is a delicate, exact process. One of the first steps is guiding the copper wire into a cylindrical core. SDC needed a vision system to identify the location of the lead wire, another one to measure critical dimensions of the ignition coil during assembly, and finally a system to ensure the completed part met the required specifications.

The number of vision systems required for the project – and their different functions – pointed manufacturer in one direction: Cognex. "I prefer Cognex because their products integrate seamlessly into the Rockwell PLC control system that we use on almost all our machines – more seamlessly than

In-Sight 8000 Smart Cameras

Cognex In-Sight 8000 series smart cameras combine the power of industry-leading vision tools with the ultra-compact form factor of a traditional GigE Vision camera and are available with resolutions from 0.3 to 5 megapixels. Powerful software tools allow users to perform diverse image processing algorithms, color extraction, advanced defect detection, barcode reading or pattern matching tasks even at high speeds. Basic tools such as blob, edge, histogram, and non-linear calibration are also integrated. The EasyBuilder user interface enables simple step-by-step application setup, but advanced flexibility is also provided via spreadsheets and scripting.

All Images: Cognex/SDC

Cognex touchscreen displays show plant personnel failures that occur in real time, enabling faster optimization of production processes.

most other manufacturers," said Neil Davis, an electrical engineer at SDC.

For ignition coil quality testing, the machine builder implemented several smart cameras from the In-Sight 8000 family. To inspect critical dimensions of the parts during assembly, the In-Sight 8402 model with a resolution of 1600 x 1200 pixels is used. This ensures that the ignition coils meet all tolerance requirements. The inspections are carried out in a stationary manner as the system moves the ignition coils step by step past the vision systems. The typical dwell time of less than one second gives the In-Sight 8402 systems sufficient time for image acquisition and evaluation.

This way, Cognex In-Sight vision systems automate an otherwise time-consuming part of the inspection process and ensure that only those parts that meet the required specifications make it to the next stage of the production process. Faulty ignition coils, on the other hand, are reliably detected and ejected.

Benefit From Advantages

In addition to the reliability of the systems, SDC's customer, a manufacturer of ignition coils, benefits from further advantages. For example, the In-Sight smart cameras are connected to Cognex VisionView 900 touchscreen displays to show plant personnel what types of failures are occurring in real time. These 9-inch control panels provide users with helpful management tools for cameras, sensors and images close to the production line, without relying on PCs or laptops. Their IP65 rating protects them from moisture and makes them insensitive to vibration, allowing their use in a wide range of applications. The combination of In-Sight cameras and VisionView operating panels enables the unerring analysis of failures and thus contributes to the faster optimization of production processes.

Another advantage of the In-Sight vision systems is that they are stand-alone cameras with integrated evaluation that do not require a PC and therefore take up less space and fewer cables than other solutions in the control cabinets of the SDC plant. The ergonomic, compact design of the system therefore enabled the customer to save even more space – a valuable asset in any production facility.

For ignition coil quality testing, SDC implemented several smart cameras from the In-Sight 8000 family.

Customized factory automation systems from SDC and machine vision from Cognex ensure effective quality inspection of automotive ignition coils.

"Our customer immediately achieved higher throughput thanks to the In-Sight vision systems and better understood operational strengths and weaknesses of their plant than before," enthuses Neil Davis. "In addition, Cognex's advanced yet easy-to-use vision tools allow users to implement software-based solutions on the fly and use them to identify and correct inspection-related issues." ■

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Image: AIT

Scantor Reads Codes On-the-Fly

The AIT Smartgate is a scan gate that is used, among other things, in the area of the truck loading ramp. This allows all 1D and 2D codes on a pallet to be automatically scanned and recorded on one, two or three sides while the pallet is moving.

The pallet is moved through the scan gate via a conveyor, a lift truck or a forklift. The maximum movement speed is around one meter per second or four kilometers per hour. The system automatically triggers the reading via the built-in light barrier. The read codes can be transmitted to a higher-level system or a controller via Profinet or TCP/IP. The data can also be pre-sorted using a built-in script.

www.ait.de

Image: Bicker

UPS Solution for Long-Term Backup

Bicker has introduced a DC UPS solution for long-term bridging. The 24V emergency power supply is equipped with the particularly safe and durable LiFePO4 battery technology and offers backup times of up to 100 hours. Consisting of the intelligent UPSI-2406D charging and control unit and the BP-LFP-13250S battery pack, the DC UPS solution is ideal for protecting embedded industrial PCs, controllers, drives, sensors, measuring systems, lighting and security technology and many more further applications. In the event of a power failure, voltage dip or flicker, system failures and data loss in safety-relevant applications can thus be effectively avoided. In addition, the new UPS management software 'UPScom' with cross-platform technology offers functions for monitoring, parameterization and messenger services.

www.bicker.de

Image: Göpel

New Version of AOI System Software

The AOI system software Pilot AOI Version 7 offers numerous new functions in terms of performance and convenience. Since small and medium-sized service companies may not have any Gerber data available for the AOI program creation, a function was integrated with the new software release, which this information is automatically generated using a bareboard. In combination with placement data and a finished module, the Magicclick function can then be used as usual for automatic test program creation.

In order to continue to do justice to the status "THT AOI expert", the creation of test programs for through-hole components has been simplified. The basis for this is the import of ODB++ process (OPM) data from which THT-specific information such as size, shape, color, etc. is used to automate the otherwise manual process for defining the test tasks. **www.goepel.com**

Image: LMI

3D Sensor Models with a Wide Field of View

LMI has introduced its new Gocator 2540/50 high-speed, wide-field-of-view 3D line profile sensors. These offer the high scanning speed of the 2500 series with the benefit of a larger field of view for better scan coverage. These compact 3D smart sensors deliver high-speed 3D measurement and inspection of a variety of materials including shiny EV battery packs and consumer electronics assemblies made of machined metals, various railway materials, hot-rolled rail steel, and low-contrast materials like black rubber tires.

www.lmi3d.de

Image: Teledyne Dalsa

4K 3D Laser Line Profile Sensor Family for Inline Measurements

Teledyne Dalsa introduces the Z-Trak LP2C 3D profile sensor family for 3D measurement and inspection applications. As the newest member of the Z-Trak family, the LP2C 4K sensors deliver 4,096 pixels per profile and resolution down to 3.5 microns, allowing customers to measure and inspect parts to tighter tolerances and identify minor flaws cost-effectively.

Teledyne's Z-Trak LP2C 4K sensors work right out of the box. They are factory calibrated and combine high sampling speeds with easy-to-use software tools that provide highly repeatable and accurate height, width and length measurements. Due to its compact size and easy wiring, the Z-Trak LP2C is ideal for battery, automotive, factory automation, robotics, and logistics applications.

www.teledynedalsa.com

Image: Nikon

Analysis Software with Artificial Intelligence

Nikon has introduced the artificial intelligence based LiB.Overhang analysis software. The software enables a high production yield to meet the increasing market demand for batteries and leads to a reduced number of expensive warranty claims from users of electric vehicles, energy storage systems and other battery-powered devices. The goal of the LiB.Overhang analysis is to encourage more in-line inspections earlier in the manufacturing process to improve product quality. By combining this new analysis approach with the micro-focus X-ray source, rotating target and half-turn CT technology, Nikon offers a complete solution.

www.nikon.de

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KV Inspect is a flexible system solution for print image inspection, with the option of one or more cameras.

Flexible Quality and Process Control of Printed Products

Pharmaceutical packaging products need to be thoroughly inspected during production. An automated print image inspection system ensures conformity with current requirements.

The pharmaceutical industry was already applying the strictest quality standards in the production and logistics process even before the introduction of mandatory track & trace solutions. The health and safety of patients has always been a top priority. This applies not only to the actual production of medicinal products, but also to all printed products, such as leaflets. After all, this is where you find precise information on dosage and intake, notes on potential risks and side effects, as well as information on legal provisions. This makes the leaflets the most important source of information for doctors and pharmacists as well as for patients.

Mastering the Print Production Challenge

It is therefore established practice for these printed products to be inspected throughout the production process to ensure the quality of the print. Generally speaking, companies that specialise in printing and finishing leaflets are also obliged vis-à-vis their customers to document the respective results in a traceable manner. As these are very fast processes, the use of powerful image processing components is indispensable. These enable the seamless inspection of individual products and a consistently reliable process.

The long-established company Faller Packaging with seven locations across Europe, including in Germany, Poland, Denmark and Hungary, has been using automatic camera inspection for product detection for some time now and was faced with the challenge of initiating a generational change of this technology in print finishing. As a leading supplier of pharmaceutical packaging, the company offers customized products in the areas of folding cardboard boxes, self-adhesive labels and leaflets, and combines these into individual all-in-one solutions. As the tasks in the pharmaceutical industry become more complex and specific, the demands on leaflets are also increasing. The introduction of the Readability Guideline, for example, is intended to ensure better readability. However, this leads to texts using up to 30 percent more space. Icons or images are also being used more frequently, which also increases the amount of space required. The result is a wide variety of continuously growing formats that increase the challenges in the production process of print products. An intelligent machine vision solution is required.

A Flexible Solution for Automated Print Image Inspection

To this end, the Saxony-based company Kaiser Vision, an machine vision expert with 25 years of experience, has developed a flexible system solution for automated print image inspection in close cooperation with Faller Packaging. This solution combines optimally adapted software and the crucially important interaction between camera and lighting technology. Directly after printing and cutting the leaflets, an essential process step is the folding. The cut sheets are folded to the final format specified by the customer. Typically, multiple folds are made in one direction. Alternatively, a transverse fold can be made in a second process step. The key task of automatic inspection here is to check the presence and correctness of the printed image on both sides. The aim is to reliably exclude sheets printed only on one side and

Well-designed and stream-lined user interface for intuitive use.

The use of KV inspect is possible in a wide range of machines, including punching and folding machines or even banding machines.

any mixing with other products from the next stage of the process. The detection of the printed sheets takes place directly after separation and before the actual folding, as this is the optimal point at which the products can be inspected by the camera systems. A one or two-dimensional code, e. g. a barcode or a data matrix code, is often used on leaflets to uniquely identify the processed product. The system records this and compares the content with the respective specification. Other inspection algorithms can also be used to check the presence and correctness of any printing, such as a logo or unique text.

The Ideal Interaction between Camera, Lighting, and Algorithms

The Kaiser Vision KV inspect system allows quick and easy definition of detection areas and criteria, meaning that product changes require only a minimal amount of time. The system reliably checks every sheet passing through the folding machine. A reject gate integrated in the system can be controlled by the inspection system precisely for each individual product in order to reliably separate out defective products. If deviations from the defined parameters are detected, the process is automatically interrupted and the press is stopped. This minimises the production of non-conforming print items and the associated waste. These defects can be defined individually, enabling the end customer to make specific adjustments. A range of deviations from 0 to n can be defined for this purpose. When a product is changed, the KV inspect system automatically creates a complete and clear inspection report in the form of a PDF file. This ensures the complete documentation of the individual results. In addition to efficient and reliable algorithms for the machine image analysis, the selection of the hardware is of course decisive for the stable and reproducible function of the overall system. To achieve the optimal inspection and analysis of the individual test objects in a stable process, the focus was on the ideal interaction between camera technology, lighting and powerful algorithms. When choosing the camera, it was particularly important to combine a compact design with excellent technical properties. As the inspection processes involve very fast sequences of individual image captures and the analysis of these, it is essential to have both a short exposure time and homogeneous illumination of the image field. Due to the high demands on the required illumination system, the choice fell on one of the most powerful miniature ring lights on the market, the Lumimax LSR24 from IIM, manufactured in Thuringia. Decades of expertise in the field of machine vision illumination combine maximum performance in the smallest installation space. In order to eliminate any possible blurring due to movement and to achieve minimal exposure times, thereby keeping the process stable, the lighting systems are used in flash mode. The defined light pulse and the synchronised image acquisition enable the print image to be captured perfectly. The LEDs driven over-current in flash mode provide maximum light output. The LSR24 Miniature Ring Light is thus the ideal solution to meet the requirements of installation space and illuminance. In addition to the IP67 protection rating, the LSR24 enables easy adaptation of diffusers, polarisers and other optical accessories such as darkfield attachments and dome coupling. To achieve an absolutely homogeneous illumination of the detected area, the kvInspect system uses a diffuser with perfectly coordinated transmission.

> «As the inspection processes involve very fast sequences of individual image captures and the analysis of these, it is essential to have both a short exposure time and homogeneous illumination of the image field.»

Intuitive and Uncomplicated Pperation

Faller Packaging has already installed the KV Inspect 100 percent inspection system in various print finishing machines at its Binzen site and is planning to purchase additional systems. The decision-makers were impressed, among other things, by the excellent inspection performance, the comprehensive inspection reports as well as the quick installation and the compact size while the production employees appreciate the intuitive and uncomplicated operation of the system. ■

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All Images: IIM

Image: Micro-Epsilon

Sensor System for Precise Turbidity Measurement of Liquids

The smart and precise Colorsensor CFO100 from Micro-Epsilon are intended for measuring turbidity. During the textile dyeing process, for example, they continuously recognize the color of the water, which allows conclusions to be drawn about the existing color concentration.

For this application, the Micro-Epsilon CFO100 controller is used together with the CFS3-A30 transmission sensor. During the measurement, the water is pumped through a side arm through a glass tube, which is illuminated from the back with the transmission fibers of the CFS3 sensor. The color haze is evaluated and classified in the controller. The determined color value is then output directly to the process control. In this application, the measurement can be taken from the outside of the pipe or directly in the water. **www.micro-epsilon.de**

Image: Creaform

High-Precision Handheld Scanner

Creaform has expanded its Handyscan 3D Black series with the high-precision Elite Limited handheld scanner. This handheld scanning solution is suitable for any application in quality control or product development where tolerances require higher accuracy, while being portable and flexible. The 3D scanner is twice as accurate as the Elite model, which has been verified by ISO 17025 accredited calibration based on the VDI/VDE Part 3 standard.

www.creaform3d.com

Image: Micro-Epsilon

Automatically Measure Railway Straps

Mills CNC uses laser sensors from Micro-Epsilon for the automatic inspection of large, hot-rolled steel rail links. The rail straps connect two rails with each other and must be as straight and level as possible.

Both the deflection and possible distortion of the link plates are determined in a measuring cell developed by Mills CNC for the measurement task. An Opto NCDT 1750 laser sensor is mounted on a robot for this measurement task. The sensor offers a large measuring range of 750 mm. Thanks to the compact sensor design and direct data output without an external controller, integration is easy.

www.micro-epsilon.de

Image: Nikon

X-ray CT Systems with OPC UA Connectivity

Nikon is now equipping its X-ray CT systems with OPC UA connectivity. Nikon's existing systems in the production lines use a proprietary IPC interface, which requires a basic knowledge of the X-ray CT system and a software developer who understands the Nikon IPC protocol. While this interface remains in software to enable sophisticated control of all aspects of the system, shop floor applications are now supported through the industry-standard, platform-independent OPC UA interface. This means knowledgeable integrators are able to more easily integrate third-party industrial, automation and control equipment. This saves both time and money when installing or reconfiguring production line systems within a single factory or at multiple interconnected facilities around the world.

www.industry.nikon.com

Image: Polytec

Automated Testing of MEMS at the Wafer Level

In order to keep the production costs for MEMS low while at the same time maintaining a high yield and high quality, automated testing at the wafer level before the chips are separated is proving its worth more and more. By default, this is done through electrical testing procedures. However, certain test and inspection tasks require a direct, mostly optical measurement of the mechanical function of the delicate structures of the micro-electromechanical systems (MEMS).

The combination of a (semi-)automatic probe station and a microscope-based MSA-600 scanning laser vibrometer enables efficient and fast measurement of the dynamic behavior of MEMS components, and that directly on the wafer in series. MSA from Polytec helps to detect rejects early, monitor process stability and maximize yield.

www.polytec.de

Image: Vitrox

Advanced Wafer Inspection Solution

Vitrox offers the Wi8i G2 Pro Wafer Vision Inspection Handler, which is designed to provide users of the semiconductor market with high wafer handling flexibility, cover different semiconductor processes and achieve highly accurate inspection results , also an extension of the inspection capabilities of the existing Wafer Vision Inspection Handler Wi8i G2.

It meets both bare wafer (pre-dicing process) and populated wafer (post-dicing process) inspection requirements. This configuration eliminates the need for hardware conversion on the wafer robotic arm when inspecting these two wafer types of the same size, which is suitable for a production that includes both pre- and post-dicing processes and/or a high-mix-low process includes.

www.vitrox.com

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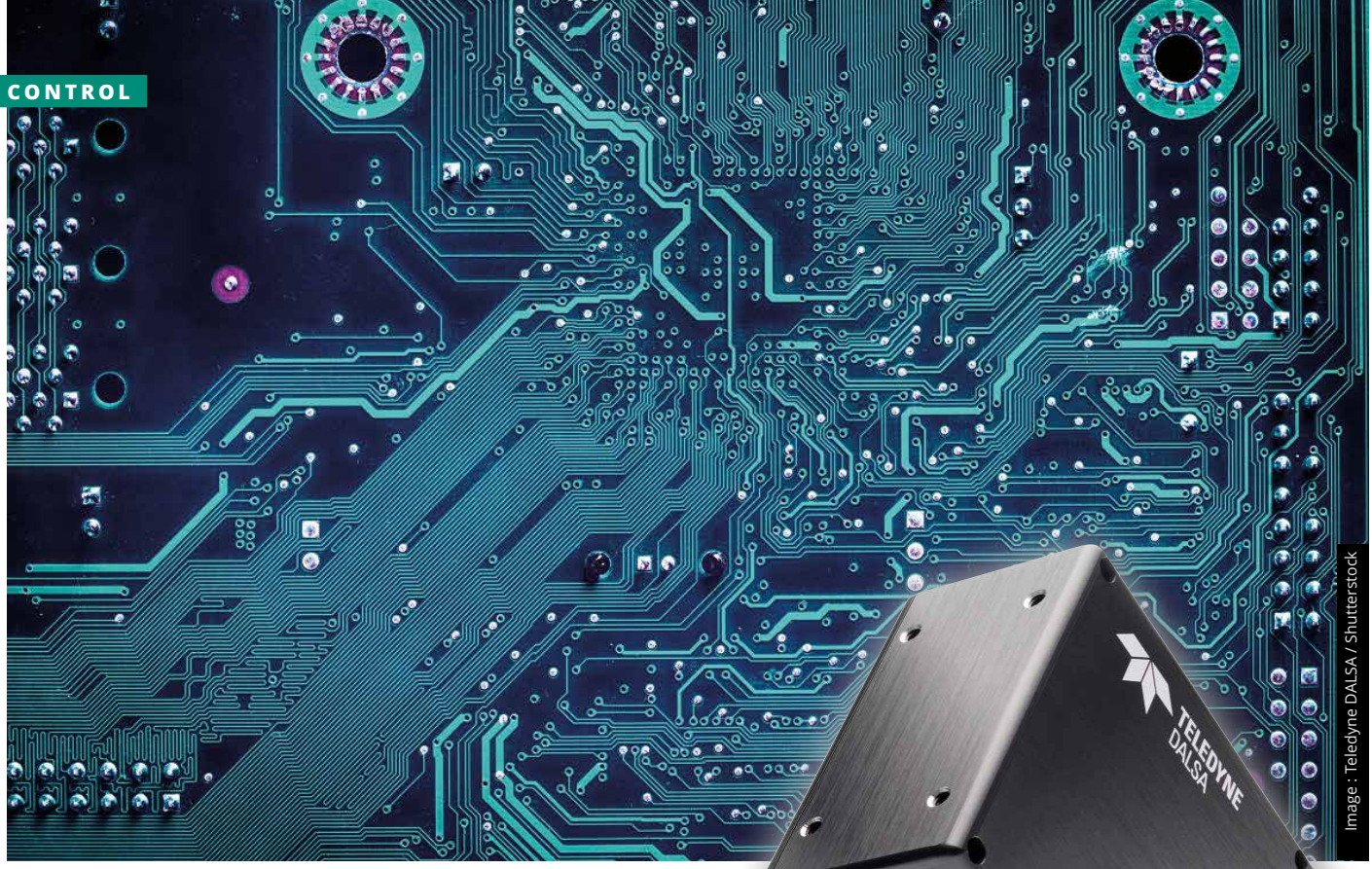

Image : Teledyne DALSA / Shutterstock

Image: Teledyne Dalsa

With the Z-Trak2 model family, Teledyne DALSA enables economical solutions for high-speed inline 3D inspection.

Where Imaging and Quality Inspection Intersect

Industrial 2D and 3D Imaging Solutions Prove their Reliability in Testing, Error Detection, and Inspection

Difficult production conditions require not only sophisticated products for a wide range of applications, but also reliable support and the manufacturer's assistance in solving customer requirements. Successful partnerships prove what the industry is capable of.

Testing of electronic components

In recent years, Phil-Vision, based in Puchheim, Germany, has gained a great deal of experience in a wide range of industries, including the electronics industry. Part of the production of electronic components are so-called hot processes in which, for example, hot chemical vapors are deposited on the blank wafers. The quality of the process must be subsequently checked and rechecked. Due to the difficult production conditions, only industrial cameras that deliver accurate results even in an increased temperature range are suitable for this. Over the years, Phil-Vision has successfully integrated Teledyne Dalsa's machine vision components for a wide variety of applications.

"In our rugged environment, the Genie camera series have proven to be a good choice," reveals Phil-Vision's Chief Vision Design Officer Patrick Gailer. "These cameras deliver high-quality images even at elevated operating temperatures and have a very low failure rate. In the rare cases where failures did occur because of the extreme conditions, Teledyne Dalsa provided a quick and efficient response, and replacement cameras." As a further advantage, besides the mechanical robustness, Gailer cites the numerous variants of the Genie camera series which offer a suitable model for almost every conceivable 2D machine vision system application in terms of resolutions and interfaces. "In addition, we very much like to use the camera series for setting up multi-stereo systems, as these cameras can be synchronized easily and precisely via the Precision Time Protocol (PTP)," Gailer continues. "Based on this standard, the use of a trigger cable can be omitted, and synchronization takes place exclusively via the network. Genie cameras offer the simplest and most precise control we have found on the market for this purpose."

Line by Line Error Detection

In applications where products move on a gantry or for web inspections, line scan cameras have proven to be a more suitable technology than area scan cameras. The images are captured line by line and are then combined to form a theoretically infinitely long

◀ Machine vision from Teledyne Dalsa ensures defect-free products in the electronics, automotive, aerospace and many other industries.

image. Products that benefit from line scan inspection include, among other things, steel coils, currency, paper rolls or textiles.

We also regularly rely on the line scan camera models from Teledyne Dalsa, emphasizes Gailer: "Our partner's line scan camera portfolio is unique to the machine vision industry – with several series that combine many resolutions, speeds, and interfaces. In the Linea, Piranha, Eliixa and Uniiqa product lines, models with dual-line and TDI technology as well as SWIR and multispectral line scan cameras are available in addition to conventional line scan cameras. No matter the application or industry, we have always found the perfect line scan camera to meet the demands of our customers."

Inspection in 3 Dimensions

3D imaging technology has evolved a great deal in recent years offering much simpler solutions to many applications that cannot be realized with 2D systems or were only possible with considerable effort. The fact that 3D vision systems now enable much more viable options is due in part to parallel advances in sensor quality and speed, embedded image processing systems, FPGAs, lasers, optics, and smart systems. This technology is now cost-effective, reliable, repeatable, easy to implement, and has proven itself in a wide range of demanding applications.

As an example, Gailer cites the optical inspection of brake discs in the automotive industry which enables better matching of defects than 2D image processing systems: "Since brake discs are manufactured in grey cast iron, they can have holes that are then exposed during grinding. These holes on the surfaces must be dimensioned and the depth of the balance milling must be measured." In addition to the pure safety aspect of automotive brakes, Gailer says component finish is also becoming increasingly important, as they are visible in certain cars and thus part of the visual appearance. Brake discs with visible defects are not acceptable to buyers of these high-priced vehicles, even if the braking function is not impaired because of these defects.

Inspecting brake discs is not easy due to the lighting situation: their surfaces are polished and have grinding grooves that are unavoidable during production and produce certain artifacts. To make matters worse, fingerprints or fine-grained sand as a residue of the preceding grinding and washing processes are easily misidentified as unacceptable defects by 2D image processing systems.

"For this system, we used a Z-Trak2 series 3D profile sensor which is laser triangulation-based and offers a high scanning speed of up to 45,000 profiles/s which makes it one of the fastest 3D scanners on the market. With a resolution of 2,048 pixels per profile, as well as its rugged, compact design, Z-Trak2 is perfectly suited for this application. These IP67-rated 3D vision systems are pre-calibrated, so they can be integrated into inspection systems with little effort." By using a Z-Trak2, Phil-Vision was able to solve the application more effectively and at a lower cost to the customer.

« The Z-Trak2 series 3D profile sensor is laser triangulation-based and offers a high scanning speed of up to 45,000 profiles/s which makes it one of the fastest 3D scanners on the market.»

Applications with Several Cameras

With the Vicore multi-camera vision system, the manufacturer offers a powerful system that allows the combination of a wide range of 2D and 3D cameras. "With a Vicore system, we were able to implement a system at a major European food manufacturer to check the presence of cookies, their correct dimensions, the correct degree of browning, and their number and distribution on baking lines," Gailer recounts. "A perfect baking result can only be achieved under optimal conditions, which is why it was so important to adapt the vision system exactly to the specifications when implementing this application." In this application too, the robustness of the machine vision system represents an important criterion for ensuring trouble-free 24/7 operation. ■

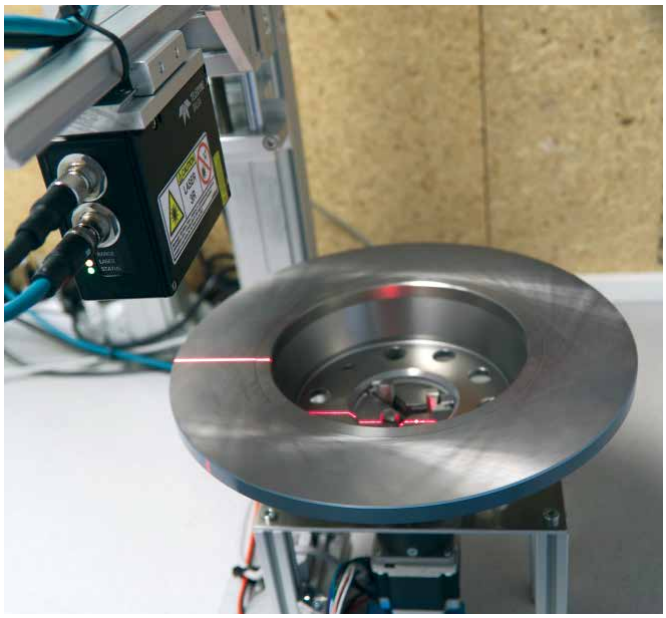

Image: Phil-Vision

With a 3D profile sensor of the Z-Trak2 series from Teledyne DALSA, phil-vision has implemented an effective, cost-optimized system for the optical 3D inspection of brake discs.

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Index

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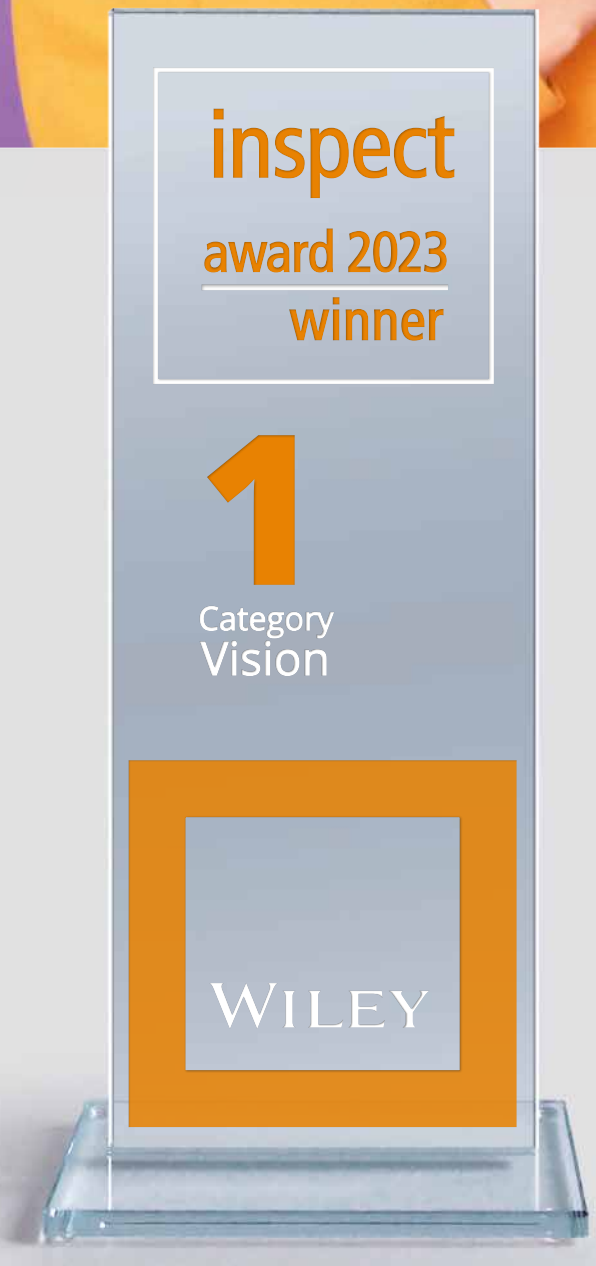

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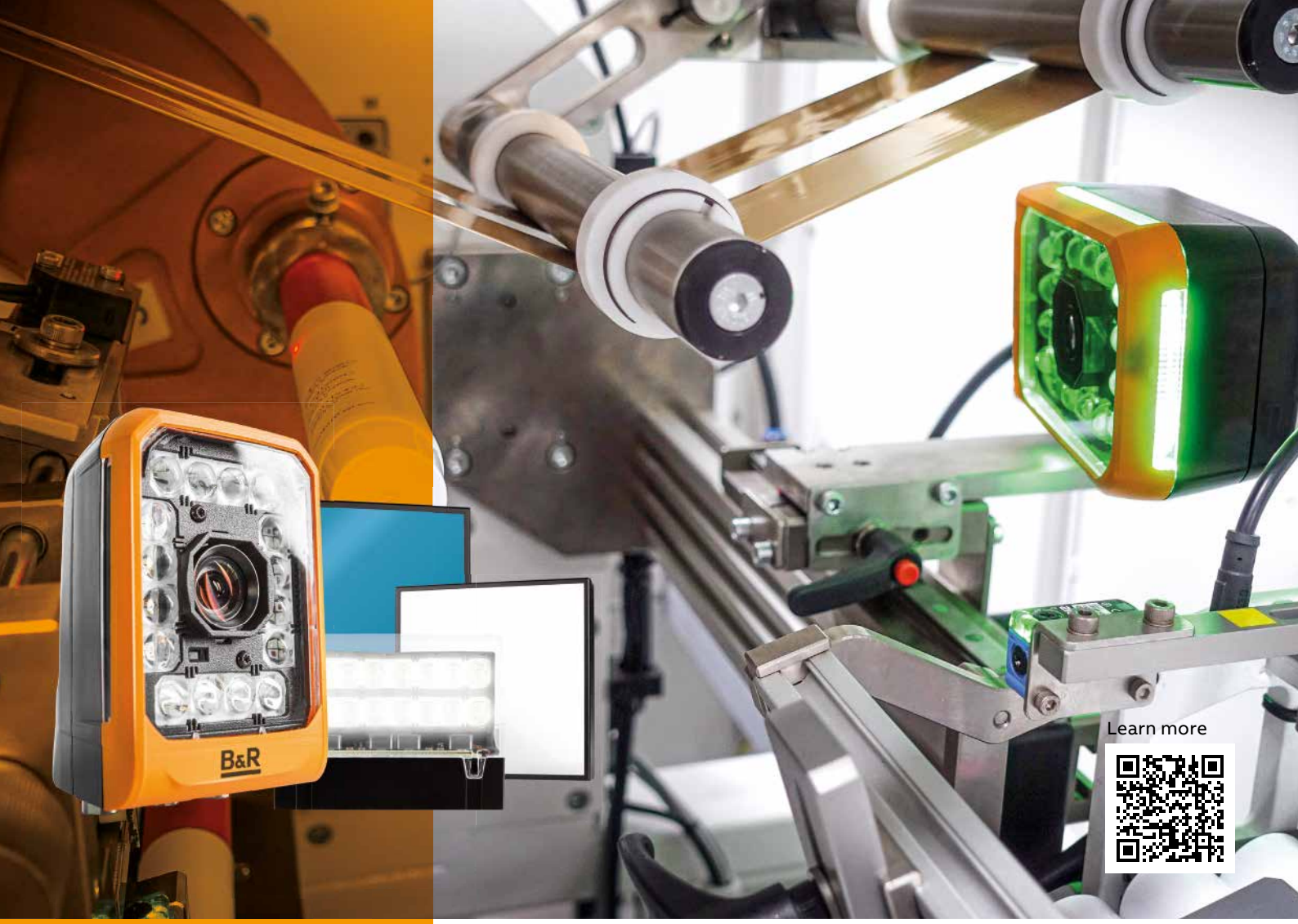

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