

THE MACHINIST

ULTIMATE GUIDE TO PROFITABLE MANUFACTURING

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EV FROM SCRATCH

Evaluating thermal runaway of batteries before manufacturing EVs for India

ROBOTS TAKING OVER

How shortage of blue-collared workers is giving rise to factory floors of robots & cobots

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Reformations are underway for Audi India. **Balbir Singh Dhillon, Head, Audi India**, dives deep into Audi's plans for India business and how they are shifting gears to change India's luxury vehicle segment, making it greater and greener



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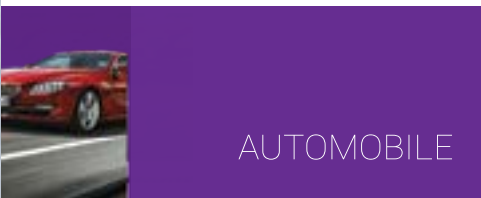


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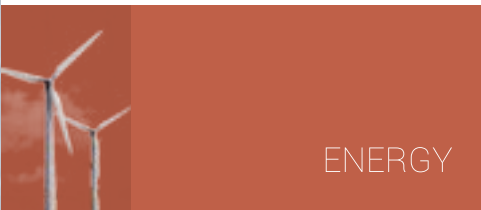


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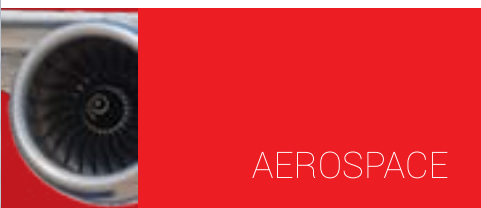
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START-UPS, SUSTAINABILITY AND DIGITALISATION

It is the AGM season for India Inc., and some of the largest corporations in the country that are part of the BSE Sensex have already published their annual report for FY22.

The two common themes emerging from a quick look at this year's reports are:

1. Sustainability
2. Digitalisation

India Inc's clear and increased focus in these two areas seems natural because today, no company, sector, or individual is insulated from the impact of technology and climate change, directly or indirectly. The annual report is an important communication channel between an organisation and its stakeholders. A quick look at the AR gives a synoptic view of what's happening inside the firm and in the sector.

Many companies have adopted the <IR> Framework to embed integrated reporting and integrated thinking into their annual reporting cycles, operating activities, and strategic planning.

Also, this is the first year you can read Business Responsibility & Sustainability Reports, as some corporations have already adopted the SEBI-mandated BRSR framework.

Meanwhile, the mid-year data on start-ups published by The Department for Promotion of Industry and Internal Trade (DPIIT) in the Ministry of Commerce and Industry suggests that India is now the third largest start-up ecosystem after the US and China with 72,933 start-ups across 56 diversified sectors. Of these, 34,473 start-ups, or 48 per cent, are from the metro cities including Delhi, Mumbai, Kolkata, Chennai, Hyderabad, Bengaluru, Pune and Ahmedabad. Interestingly, over 52 per cent of the recognised start-ups are from Tier II & III cities. This clearly shows the growing popularity of start-up culture in non-metro cities.

If you all look closely, the Startup India programme witnessed a massive jump from 471 in 2016 to 72,993 in 2022 – a whopping jump of 15,385 per cent. Today, there is at least one such start-up from every state and union territory. The start-ups are spread across 640 districts and have reportedly created over seven lakh jobs.

That said, in the current edition we have an exclusive interaction with Balbir Singh Dhillon, Head of Audi India. The cover story discusses Audi's game plan for the future, the revival story of Audi India post the lockdown, the growth of the luxury vehicle segment, Audi's new business pre-owned vehicle business and how government can support the luxury vehicle segment going further.

The August edition also touches on some important issues like data security, the use of technology in the textile sector and the prominence of simulation in the manufacturing sector. What's more, you can also go through an interesting piece on Robots Man's (Next) Best Friend.

Happy Reading

Rahul Kamat
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YOUR GLOBAL CRAFTSMAN STUDIO

The Chiron Group Acquires Spindle & Fixture Specialist In Croatia



The Chiron Group, headquartered in Tuttlingen, Germany, continues to follow its global growth strategy in 2022 too, and has announced its takeover of 90 per cent of the Croatian company HSTEC.

The name HSTEC stands for »high-speed technique«, for system expertise in developing, designing and manufacturing high-speed motor

spindles for challenging machining. Clamping devices for machining centres and automation solutions complete the portfolio. Furthermore, HSTEC is leading the way in spindle services and repair for in-house products and spindles from other manufacturers.

With the acquisition, the Chiron Group is expanding its capacities and strengthening

three areas of expertise: Complete development, manufacturing and assembly of the critical components, motor spindles and turning spindles for the Group's machining centres. With HSTEC fixtures for workpiece clamping, turnkey projects can be designed even better in line with customer-specific specifications. Furthermore, the Chiron Group is

expanding its services globally to include part repair, refurbishing and optimising all motor spindles in existing machines.

With the new name Chiron Croatia, the Chiron Group has a presence in eastern Europe with another of its own companies; it can support customers better in the region and will continue to develop at the Zadar site. Over 100 employees, 25 of whom alone work in engineering, increase the number of employees in the Group globally to around 1,900.

The current CEO Mladen Šarlija has been appointed Managing Director of Chiron Croatia. The representative offices of HSTEC in Germany, the USA and China will remain, as well representation of Balluff, Bosch Rexroth, Hofmann and Mitutoyo for the Croatian market.

HSTEC will continue as a brand, joining the ranks of the Chiron Group brands: Chiron, Stama, Factory5, CMS, Greidenweis, and HSTEC.

Godrej & Boyce Targets 35% Growth In Commercial Aviation Business

Godrej & Boyce, the flagship company of the Godrej Group, has stated that its business Godrej Aerospace is targeting a 35 per cent growth in its civil aviation business. This is owing to the 50 per cent surge in demand witnessed in this segment from global majors, including OEMs and engine manufacturers. With domestic travel recovering globally and international travel scheduled to reach pre-covid levels by 2025, the demand for civil aviation is accelerating. The business is further eyeing three times growth by FY25 owing to the rising demand for aerospace components and parts as travel trends lift.

The business announced that technology expansion and increasing global presence would drive this growth. This projected growth is also fuelled by major engine manufacturers and global OEMs taking a keen interest in India. Catering to the current demand, Godrej Aerospace is seen as a preferred partner owing to the integrated manufacturing facility backed by capability and approvals that the company has in the aviation

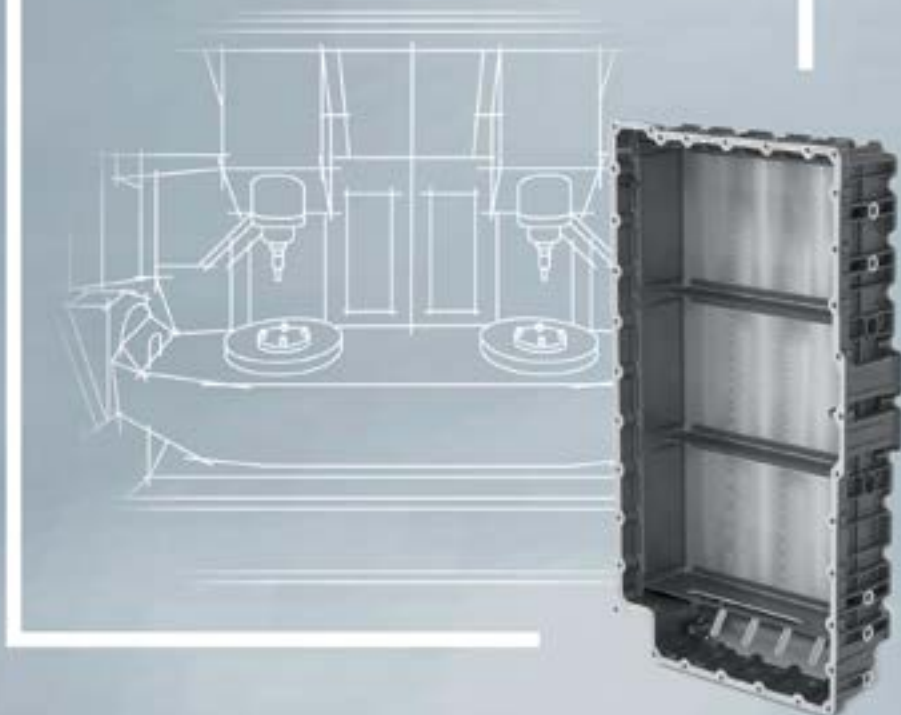
industry for over a decade. Godrej Aerospace has been manufacturing and supplying complex airworthy systems for aircraft applications, including critical sheet metal brackets, complex fabrications, hydraulic aggregates, crash-proof fuel tanks for helicopters, structural assemblies, and many other products for key global partners. The business is AS9100 certified, and NADCAP approved for special processes like chemical processes, welding, heat treatment & brazing, NDT, composites, elastomer seals, measurement and inspection and non-conventional machining. Godrej Aerospace has partnered with ISRO for over 30 years to manufacture complex systems such as the liquid propulsion engines for PSLV and GSLV rockets, thrusters for satellites, and



antenna systems.

Maneck Behramkamdin, AVP & Business Head, Godrej Aerospace, said, "The aviation sector working towards recovering from a severe economic crisis is now exhibiting confidence. Global OEMs are opening avenues for partnering with Indian manufacturers. Considering the post-pandemic economic recovery, we are projecting three times growth in the next three years in the civil aviation segment and expect this to revive further."

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Igus To Present i.Sense TR.B At Automatica 2022

Industrial robots work dynamically in welding, painting, soldering or palletising. A flexible 3D energy chain such as the triflex R from igus makes it possible to guide robot cables safely. To detect potential chain breaks due to extreme loads in good time and to avoid unplanned machine breakdowns, igus is presenting i.Sense TR.B, the world's first breakage monitoring system for 3D energy chains at Automatica 2022.

One thing above all is essential for an industrial robot to work reliably: safe cable guidance. Robot cables must withstand numerous flexing cycles as well as loads due to torsion and tension. With the triflex R, igus has developed a round energy chain with a defined bend radius specifically for industrial robots to protect the cables even during dynamic rotational and pivoting movements. The motion plastics specialist igus has developed a new, cost-effective solution to determine chain breakage at lightning speed and prevent expensive consequential damage: i.Sense TR.B - a real-time breakage monitoring system

for the three-dimensional triflex R energy chain.

With i.Sense TR.B, the proven i.Sense breakage monitoring of igus smart plastics is also possible for dynamic, three-dimensional applications. Customers can thus increase the safety of their robot systems with an investment of just a few hundred euros. The

i.Sense TR.B sensor is connected directly to the PLC customer control - without additional software costs. If a chain link breaks, the system detects the change in length of the rope installed in the chain and can accordingly send out a digital signal to the system control. Instant breakage detection enables immediate maintenance measures and can thus avoid unplanned downtimes and total failures in the event of individual chain link breakages.

With the help of numerous test series in the industry's largest test laboratory, igus is continuously working



on further optimising the quality and durability of its products—the combination of flexible triflex R 3D chain with high tensile force absorption and i.Sense TR.B sensor makes it possible to safely guide and protect robot cables – thus significantly increasing their service life. Condition-based maintenance using the TR.B sensor makes maintenance more sustainable, as users can avoid unnecessary or premature product replacement. And if there is a chain break, the sensor can be reused after the correct emergency shutdown of the system.

Trelleborg Introduces Orkot® C620 For Light Weighting & Extended Lifetime



Light weighting is the new design concept used in many industries, especially aerospace applications and is associated with green aviation. The aerospace industry is continuously evolving, and there is a long-term trend toward adopting new, greener materials and solutions that reduce weight without compromising performance or service life. According to Reports on Propulsion

and Research, an effective way to increase energy efficiency and reduce fuel consumption is by reducing aircraft mass, as a lower mass requires less lift force and thrust during flight. In addition to reducing carbon footprint, flight performance improvements such as better acceleration, higher structural

strength and stiffness, and better safety performance could also be achieved by lightweight design.

In line with the light-weighting design in the component industry, Trelleborg Sealing Solutions has introduced Orkot® C620 material that pushes the boundaries of composite technology. It has been specifically designed and developed to meet

the needs of the aerospace market, particularly for a strong and light material to withstand high loads and stresses over the long service life, making it ideal for landing gear.

Orkot® C620 is light in addition to being strong. The careful selection of ingredients within the material makes it versatile enough to be used across multiple elements of the aircraft, including landing gear, structural components, and applications within the interior. This allows standard metallic components within the aircraft to be replaced with Orkot® material, reducing weight and increasing fuel efficiency.

This high-specification material builds upon regular composite formulation by featuring a strong glass fibre backing alongside a low-friction Orkot® lining. The properties of the different layers increase load capacity and strength while reducing friction and wear to maximize efficiency and service life.

TVS SCS Appoints Tarun Khanna As Independent Director

TVS Supply Chain Solutions (TVS SCS), part of the \$2bn TVS Mobility Group, which is among India's largest and fastest-growing supply chain solutions providers, has appointed Tarun Khanna as an Independent Director to its board. This appointment takes the board's strength to eleven members, of which four are Independent Directors.

R Dinesh, Executive Vice Chairman, TVS Supply Chain Solutions, said, "I am delighted to welcome Tarun to our board as we prepare to go public. He brings a deep understanding and knowledge of how entrepreneurship and innovation can be harnessed to build companies of global relevance and scale from emerging economies. He had been instrumental in shaping our approach to build a differentiated tech-led supply chain business in the early days, and now he joins the board to help us scale faster and further."

An academician, author and

economic strategist, Tarun Khanna is the Jorge Paulo Lemann Professor at the Harvard Business School (HBS). For over two decades, he has studied entrepreneurship as social and economic development in emerging markets. At HBS since 1993, after obtaining degrees from Princeton and Harvard, he has taught courses on strategy, corporate governance and international business to MBA and PhD students and senior executives.

On joining the Board of TVS SCS, Khanna said, "I am happy to join the board of TVS SCS and be part of a values-led company, which is entering its next growth phase. TVS SCS has played an important role in revolutionising the supply chain industry and has built deep capabilities in this space. The company is well poised to address the tremendous growth opportunities ahead. I look forward to working closely with the leadership team of TVS SCS to help further strengthen and rapidly grow the business."

Khanna serves on numerous for-profit, and not-for-profit boards in the US and India, including AES, a Washington DC headquartered global power company, and inMobi, India's first 'unicorn'. More recently, he has been part of numerous commissions for the Government of India promoting entrepreneurship and higher education reform.

In 2016, Khanna was recognised by the Academy of Management as an Eminent Scholar for Lifetime Achievement in International Management.



Vitesco Technologies Inaugurates Plant Of The Future In Pune



Vitesco Technologies, a leading international manufacturer of modern drive technologies and electrification solutions, recently inaugurated its plant of the future at Talegaon, Pune. Klaus Hau, Member of the Executive Board at Vitesco Technologies, and Anurag Garg, Managing Director & Country Head of Vitesco Technologies India, attended the event.

The all-new facility is spread across 20 acres and contains more than 17,580 sq mts of manufacturing space, including over 900 employees. The company will concentrate its efforts at this facility on the growing demand for highly efficient, low-emission technologies for internal combustion engines and electri-

fied and all-electric drive systems. The first series of productions will be for the two-wheeler market, followed by various Powertrain Solutions products such as engine management systems, sensors, and actuators, as well as exhaust management components for passenger cars and commercial vehicles.

The objective is to achieve a twin technological transformation: from fossil fuels to renewable energy and from analogue - to - digital technology. The company aims to embrace this transformation and have begun to design our strategic course. Also, with the new facility, it aims to better respond to market demands and developments in the future. Like all Vitesco Technologies facilities, this cutting-edge plant in Pune meets its grid demand entirely through renewable energy sources and generates sustainable electricity.

All new photovoltaic systems have been installed, generating 03 GWh of solar energy. The present installed capacity is 2.6 MW, with the company aiming to raise it to 3.6 MW by the end

of the year. With over 25 cobots and robots installed on the production lines and shopfloor, the facility is also strongly pursuing automation, digitisation, and Industry 4.0.

Anurag Garg, Managing Director & Country Head of Vitesco Technologies India, said, "Our mission is to develop highly efficient, low-emission technologies for internal combustion engines and electrification technologies for all types of vehicles in India. For this, we build a futuristic plant, one that is intelligent, sustainable, and predictive. With these key characteristics, we were able to construct this plant of the future in Pune. Several creative projects have been completed at this facility. These digitisation, automation, and sustainability projects across our manufacturing network have helped us shape the Plant of the Future."

He added, "Due to the growing carbon footprint, we also considered the climate change while building this facility. I am delighted to say that the facility in Pune is operating at a carbon-neutral level and has fully established itself as a driver of sustainability".

By Rahul Kamat

“ORGANISATIONS SHOULD SIGN NDCS THAT BIND EMPLOYEE TO SECRECY”

In an interview **Satyamohan Yanambaka, Chief Executive Officer, Writer Information Management Services**, talks about why organisations need a robust data breach plan that articulates each step involved in responding to a breach, the individuals and teams involved, and the timelines to complete each step.



and processes must be updated to reflect the new data protection responsibilities, including procedural guidance for responding to data subject rights requests and issuing data breach notifications.

Phase 4: Implement and test breach plans. Organisations need a robust data breach plan that articulates each step involved in responding to a breach, the individuals and teams involved, and the timelines to complete each step.

Phase 5: Identify international data transfers. Using the ROPAs (Requirement of Privacy Activities) as a starting point, organisations should seek to understand what data is transferred internationally and where it is transferred to. This includes understanding how limitations in the law may affect these transfers and beginning to adopt strategies for compliance.

Phase 6: Provide training and change management. Training is an effective tool to develop a sustainable culture of compliance.

What best practices are organisations following to improve cybersecurity and data privacy preparedness?

The best path for an organisation is to implement a strong data privacy foundation with processes and tools that are scalable to adopt new regulations. As such, organisations can begin with a six-phase approach to start preparing for data privacy regulation.

Phase 1: Understand the data flow, and classify data. Organisations must understand what data they hold, how it is used and who it is to be shared with by classifying data, implement data handling guidelines and create a record of processing activities. This document can be used as a single source of truth and to inform other compliance activities.

Phase 2: Establish governance. Identifying local representatives where appropriate and appointing data officers will be essential steps.

Phase 3: Create policies and procedures. Policies

What are the biggest issues that companies must address from a privacy perspective when they suffer a data security incident?

It is extremely important to understand the difference between an incident and a breach. While an incident compromises confidentiality integrity or availability of an information asset and may not require notification, a breach results in the confirmed disclosure—not just potential exposure—of data to an unauthorized party. Below mentioned are the three high-level areas that the incident response must include:

A timely incident response plan must identify those individuals responsible for invoking the plan and leading the response to any data security incident. The use of tabletop exercises can detail team members' respective roles, provide the necessary skills to navigate an incident, and facilitate teamwork with other appropriate personnel to manage the incident.



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When companies contemplate M&A deals, how should they factor risks arising from privacy and data security issues into their decisions?

While the rise in M&A does not necessarily correlate to an increase in breach activity, data security must be a clear problem radar for both target and acquiring companies.

Data privacy and security considerations play a critical role while developing an M&A strategy because they can impact a company's business objectives, regulatory profile, and valuation model, as well as the list of acquisition candidates or potential buyers. The consequences for acquirers that fail to perform thorough due diligence can be severe. While identifying potential risks and liabilities during cyber due diligence, parties should also understand that it is during this process, that data security and privacy breach risks exist as large amounts of sensitive and confidential information are shared with bankers, attorneys, consultants, and other parties.

What is your outlook for data security in the manufacturing industry? Does it have wider applications within automotive data?

Awareness of the effects of Industry 4.0 and the increase in cybercrime slowly came to light in 2017-18. The problem exploded in 2020 when many companies were forced to depend almost entirely on remote workers due to pandemic restrictions. While most of the world was largely unprepared for the effects of COVID-19, the manufacturing industry became the second most targeted industry by cyber attackers after finance and insurance. According to the 2021 Global Threat Intelligence Report (GTIR), this represents a 300 per cent increase in a single year.

Cyber threats to the manufacturing industry have risen to the forefront of supply chain security concerns. Cyber threats refer to vulnerabilities in IT and software systems, like malware attacks, piracy, unauthorised ERP access and unintentional or maliciously injected backdoors in the purchased, open source or proprietary software used by organisations. From autonomous cars to smartwatches, as everything is connected and becoming increasingly intelligent, the risk of an attack is higher than ever. The IoT is contributing extensively and offering an optimistic future to all stakeholders.

How is the cloud database space growing in and outside India?

Organisations are developing and deploying new applications in the cloud and moving existing assets at an increasing rate, and this will continue to increase with growth in systems for data management solutions for analytics (DMSA) use cases, such as data warehousing, data lakes and other use cases, where data is used for analytics, artificial intelligence (AI) and machine learning (ML).

According to IDC, the worldwide data management software market is forecast to be \$84 billion in 2022, growing

to \$121 billion in 2025. As cloud services mature and reduce costs, more customers will move to the cloud. Once on the cloud, the companies will realise how important it is to have flexible, affordable, scalable, and secure database management to build modern applications.

How much has India's cybersecurity awareness and practices advanced in the last two years?

AI and ML are major contributors to the advancement of cyber security. As the cyber security market continues to evolve and grow, there is an increased reliance of businesses on information technology. This has led to a growing number of security and data protection regulations. The shift of crime online as criminals seek to make money from stealing information and committing fraud, and the increasing incidence of state-sponsored cyber-attacks for a variety of reasons, including industrial espionage and the disruption of critical infrastructure.

Can you outline the context and current cybersecurity risk for manufacturing companies and the supply chain?

For many manufacturing companies, the biggest cyber threat is a lack of knowledge and training. All too often, management isn't even fully aware of the risks, and most employees have little to no training regarding how to identify and avoid potential threats. There is a lack of awareness and preparedness.

The top cyber threats & risks for manufacturing companies are as follows:


- **Phishing Attacks & Ransomware/Malware**

In the manufacturing industry, emails are the most used tools for these attacks. A criminal will send attention-grabbing emails to lead unsuspecting people to share company information.

- **Supply Chain Attacks**

Due to increasing digitisation across all aspects of the manufacturing process, manufacturers need to be aware of the threat of supply chain attacks as the information they share with industry partners or providers could be a weak link in their security.

Manufacturers need to be careful with the financial, intellectual, and operational information they give to collaborators to avoid instances of the data being used to access private networks and steal information. A background check on their dealings could help determine their trustworthiness during the expansion process.

A vast network of IoT devices throughout a long supply chain provides multiple endpoint vulnerabilities. If a criminal gains access to the device, they can interfere with production flow. Additionally, other threats such as IP theft, nation-state attacks, internal breaches, and equipment sabotage (IoT Attacks) are becoming increasingly notorious as the age of the internet grows. 

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“TEXTILE MACHINERY IS FAST-DEVELOPING & SEEING MAJOR TECHNOLOGICAL CHANGES”

Although the textile sector is amongst the oldest, it is gaining prominence using technology as a crutch. An interview with **Anil Kumar, Director, Inovance Technology India**, discussing the future of textile industry and more.



Inovance is an industrial automation group – what’s your link to the textiles industry?

Inovance is well known for creating dedicated products tailored to specific applications, and we

water jet loom shuttles in the weaving sector, and many air jet looms. We also work closely with major Indian OEMs making textile dyeing and printing machines in the weakening sector. We keep closely in touch with our OEM customers to ensure that we are always highly responsive to the market trends affecting them.

How can advanced automation technology benefit Indian textile manufacturers?

India holds a global market share in shuttle-less looms of slightly under 8 per cent. The industry in India relies on older techniques: almost every process requires some sort of labour involvement which consumes time and can certainly be improved with automation.

One example of how automation can help in textiles is face masks. Thanks to advanced automation techniques, we could help our customers produce vast amounts of face masks during the pandemic in a short time.

What new automation technologies do you see coming on stream in textiles in the near future?

Despite being an old industry, textile is a fast-developing sector which will see major technological advancements in the coming years, both in logistics and production. Cloth manufacturers are always racing to produce different compositions and



“In India, we are looking at the implementation of IIoT technologies within the textile industry. We think this is important because there is such a large installed base of textile machines in India – so the potential benefit is enormous.

do a lot in textiles. We work actively in weaving and printing applications globally, promoting our dedicated complete air and water jet solutions for machinery. Across India, we have more than 1,500

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varieties of products. They need more flexible machinery from their OEMs to enable them to compete.

In India, we are looking at the implementation of IIoT technologies within the textile industry. We think this is important because there is such a large installed base of textile machines in India – so the potential benefit is enormous.

Energy saving and waste reduction in textile mills is another aspect which cannot be ignored, and many players, including Inovance, take this very seriously. Motors consume the majority of the energy in any industry, and we will see more efficient motors that, combined with our drives' advanced vector control methods, will save significant amounts of energy. These motors will be coming on stream in the near future.

What are the main automation challenges facing OEM machine builders in the textiles segment?

Indian machine builders find it challenging to incorporate newer automation into their existing machines. One of the reasons for that is a scarcity of skilled engineers in the textiles field. There is also a general trend toward end users preferring imported machines rather than Indian-built machines. It is sometimes difficult to find a complete Indian-produced machine.

Are there any common safety issues you see with Indian textile machinery?


Most Indian-made textile machinery is very safe. Manufacturers have learned from their experiences, and with many new laws and social norms firmly in place, machine safety has been standardised and improved significantly in recent years. Compared to older machines, we see a good implementation of safety sensors and better machine body designs.

What's the most exciting thing about the Indian textile industry right now?

Challenges are part of the excitement within the industry. Studies show that India has less than an 8 per cent share of shuttle less looms globally, and almost 90 per cent of the weaving industry in India

// Indian machine builders find it challenging to incorporate newer automation into their existing machines. One of the reasons for that is a scarcity of skilled engineers in the textiles field. There is also a general trend toward end users preferring imported machines rather than Indian-built machines.

is unorganised. We see that as a challenge and also as a huge opportunity to grab. Certainly, the upcoming new generation of working professionals understands technology better. Hence, we are expecting a major technological shift from older, less efficient methods of production to newer and more advanced technologies.

Another exciting part of the textile industry is fashion, which is constantly changing day by day. Every day is a new experiment with fabric hence the challenge to produce it. We are very excited to work, contribute and be a part of this evolution. 

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By Anvita Pillai

“INDIA IS BECOMING SIMULATION CAPITAL OF THE WORLD”

With simulation taking over manufacturing, **Walt Hearn, Vice President, Global Sales and Customer Excellence, Ansys**, in a one-on-one with The Machinist, discusses the prominence of simulation, how it can make the automotive sector safer, Ansys' impact on India and more. Excerpts...



How important is simulation for manufacturing industries today? How can companies enable a connected ecosystem through their organisation?

When you think about almost every company in the manufacturing space across all industries, whether it is automotive, high-tech or healthcare, everybody right now has the initiative to try to get their products to market at a much faster pace. Some companies say they have to get their products into the market 50 per cent faster. So, they're looking at the product development process and trying to understand what components of the product development process can I shorten to get my product to market in half the time and at a lower cost. And they've identified that digital technology and simulation are crucial to getting their products to market.

Since that's happening, we're experiencing an acceleration in our business because customers are realising and leveraging more and more simulations to get their products into the market faster.

The other thread is that many companies focus on sustainability and want to reduce their product's carbon footprint in the market. Consequently, many have started leveraging simulation to help them achieve sustainability goals. They're doing that in a couple of ways. One is by leveraging simulation to optimise the materials they use in their products. By this, they can choose the materials with the lowest CO2 imprint from being ordered out of the ground to being fully recycled. It's simulation that enables them to do those designs. The second way is a simulation in nature helps reduce physical prototypes. When reducing physical prototypes, you reduce waste and CO2 footprint for developing the product. So, at its core, simulation helps impact sustainability initiatives for our customers.

How can companies work on creating a connected ecosystem throughout their organisation to ensure synchronisation between each other/departments while using simulation?

Let's assume an organisation is designing a cell phone. To understand how a cell phone operates, you have to be able to design all the various components. So, you have to understand the mechanical durability of the cell phone. You have to understand the electromagnetics of the chip, electromagnetics of the PCB board, and the thermal effects, so each one of those is a different engineering department inside an organisation. So, you have the electrical engineering department, mechanical engineering department, optical engineering department, and more. And so, to design that phone, they all have to come together.

Simulation from Ansys will be able to simulate all of those various components. We enable the engineering organisations to come together in a digital thread and simulate all the multiple components to design

their product so that the electromagnetic engineering department can understand the thermal impacts.

In terms of the positioning of India, where does India stand in the global simulation market? How can they work on becoming the best market for simulation globally?

When you think about the entire global simulation market, India is one of the most important contributors on the global scale. Large institutions like Cummins and Eaton sit in India and have massive simulation engineering departments. A lot of the simulation and its technology are done inside India. That's the scope.

If you think about semiconductors, half the world's tape-outs are done in India for the biggest semiconductors worldwide. These semiconductors are designed for those


you an example. In North America, you didn't need a backup rear-view camera on all the cars, so reversing was a big problem for people. What we've been able to do through simulation is help design and simulate new cameras to put on cars, reducing fatalities. We're also designing new radar systems to detect passengers, and that is also saving lives and lowering incidences.

Focusing on India, the main problem is battery cooling and thermal mechanism. Ansys has a lot of tools, and we'll be coming out with many online and offline events on the safety of batteries and highlighting how the thermal cooling of the battery is essential, which a lot of the suppliers and OEMs are not taking care of. They're not simulating that. Secondly, the battery's chemical composition is not done correctly here in India, where they need to use simulation.

5G testing is starting across India. How do you think it will affect the current manufacturing infrastructure? Will it require a significant investment from manufacturing companies to build an infrastructure that is 5G compatible?

There's an investment required to go from a 4G to a 5G network on a big scale. One benefit we see from 5G in manufacturing is bringing the device's intelligence to the edge. When we can connect a sensor or an antenna to a device through 5G, we can understand how the device operates in the field and leverage predictive failure before it happens. So, it reduces downtime, makes the products more efficient, and helps drive innovation. But to do that, there is an investment required from the manufacturing companies in developing smart devices and infrastructure to handle that.

How is Ansys working on building an innovation and R&D process in India? And what strategies are being implemented to make India a prominent simulation market globally?

Ansys is investing heavily in India, and we will continue to invest. We have over 600 employees in India, from R&D to sales to technical support engineers across all technology. A high percentage of these engineers are coming from the top institutes like IITs, IISc, and NITs, and several of them are PhD and M.Tech, and they are driving a lot of innovation. The Indian Ansys engineers have patented seven technologies. One of our top initiatives is women in technology. We are focused on recruiting and hiring top women with engineering degrees. So, there is a great opportunity for women in the engineering community. We plan to continue to invest and expand because we believe the talent pool in India is great. India has world-class engineers in all the different areas, and we will leverage India's talent. 

“One benefit we see from 5G in manufacturing is bringing the device's intelligence to the edge

tape-outs, so you have this massive need and desire for simulation in the semiconductor market. But it's all industries - semiconductor, aerospace and defence, automotive, industrial, energy, and so the opportunity for India is phenomenal, and its importance is very high.

India is becoming the simulation capital of the world. As we speak, anywhere from 15,000 to 20,000 Ansys engineers are working on these global companies like Cummings or Honeywell. These companies came here for lower cost about 10 years back, but they stayed for quality, and now all their global product development initiatives and innovation projects are happening out of India. So, in that sense, in terms of several engineers and the upgradation and the value chain, it has moved up quite tremendously.

Is there a way that simulation can help make vehicles safer, especially with electric vehicles and the recent incidents that happened with fires?

Simulation makes vehicles safer in a lot of different aspects. At its core foundation, all vehicle crash design is done in simulation. We enable all of the large automotive companies to run millions of millions of crash simulations virtually so that they can design the safest vehicle for humans. Thus, all crash design is done in simulation and then physically verified, which is the core of designing the safest vehicle.

What's coming next is the levels of autonomy. So, one through five, we're working on eight off features to make vehicles safer all the way up to full autonomy. Let me give

By Aadya Avinash, Head – Brand, Marketing & Corporate Communications, ANSCER Robotics

ROBOTS: MAN'S (NEXT) BEST FRIEND?

The shortage of blue-collar workers in India is giving rise to robotic solutions.

There is a common misconception that a densely populated country like India has no dearth of manual labourers. However, the landscape for blue-collar professionals has changed drastically over the years. This is as increased importance is rightfully given to employee safety, satisfaction, and work-life balance, and also on the back of technological advancements in the automation and robotics space - all of which have especially intensified in the wake of the covid-19 pandemic.

WHY THE HUMAN-ROBOT CONNECTION?

Blue-collar jobs, which involve tedious and long shifts that cause both mental and physical stress, have always been challenging to fill. These roles are majorly handled by internal migrants, who form the backbone of the economy, with India's estimated internal migrant population standing at about 100 million workers. The Center for Monitoring Indian Economy (CMIE) estimated

that in just April 2020, a shocking 122 million people in India lost their jobs, the majority being daily wage earners. The pandemic exponentially increased the labour gap as migrant workers were forced to leave big cities for rural areas due to imposed lockdowns, which left migrant workers dislocated with no income. While essential services could continue even amidst lockdowns, organisations in this category had to enforce stringent measures to break the chain of transmission, working with limited staff and social distancing. Even now, over two years since the first wave in India, there is a shortage of manual labourers as the country scrambles to get back on its feet during this tumultuous period. Multiple sectors, including manufacturing, e-commerce, and logistics, are dealing with a manpower shortage of up to 20-25 per cent, according to the staffing solution firm Teamlease Services, with a crucial chunk of the migrant population still hesitant to return to work in major cities in light of the looming virus and its seemingly infinite variants.

Even keeping the pandemic aside, the attrition rate of the blue-collar workforce in the industry has been rather high over the last five to six years. And it's no surprise when you think about it. After all, no one wants to work long hours doing physically intensive, monotonous work with little to no growth - at least not by choice. This applies even more to newer generations whose families may have been part of the blue-collar circuit for ages and was therefore encouraged to invest in educating themselves to open doors to better opportunities their parents may not have had access to. This has resulted in a migration of manual workers to white-collar positions, where they have the opportunity to earn higher wages and build more fulfilling careers. While this is excellent for the progress of our people, it has put manufacturers in a fix, furthering the demand-supply gap within the industry and creating a shortage of skilled manpower across profiles such as machine operators, welders, and warehouse workers.



Luckily, technology is at a stage where a multitude of industrial tasks can be automated - specifically through robotics. It's no coincidence that the most advanced manufacturing nations in the world, such

“The market for autonomous mobile robots in India is expected to attract nearly \$10 billion investments in the next five years. While traditional industrial robots mostly catered to large industries, the collaborative nature, fast installation, and space-saving features of cobots make them democratise automation so even SMBs (Small and Medium Businesses) can easily adopt robotic solutions.

as China, Japan, Germany, and the USA, are also the biggest users of robots, as found by annual reports by the International Federation of Robotics (IFR). So far, India has been much slower to the game, with less than 4000 units deployed in 2020, in contrast to China, which led the world to almost 170,000 robots. However, India shows immense potential for robotics. There is increased demand for precise production without compromising on quality, skyrocketing needs for digital transformation across sectors, and favourable government policies in the manufacturing sector, all slowly but surely driving industries towards robotic automation.

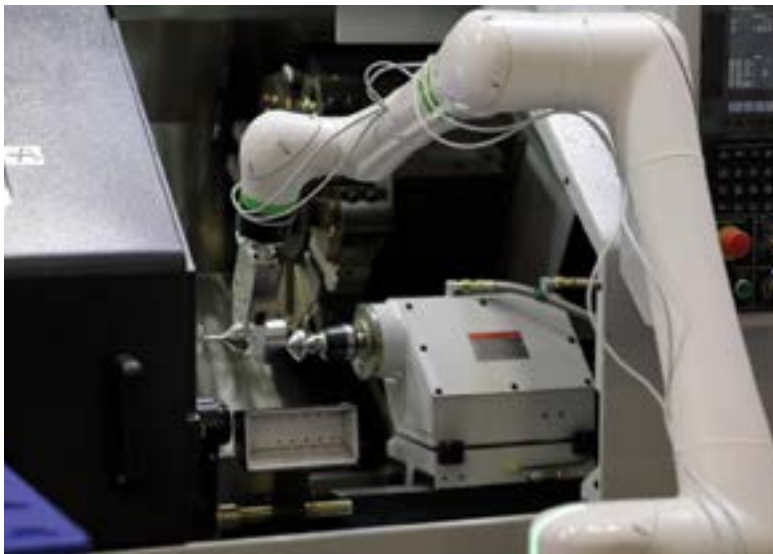
While robots have been around for decades, traditional ones were difficult to deploy, especially those with no prior experience with robots. They are also generally huge, bulky, and unsafe for humans. Conventional industrial robot arms have even maimed and - in extreme cases - killed people. This means they need to be fenced or caged off in a separate workspace and therefore require a large amount of shopfloor space when land is already scarce and expensive.

However, recent advancements in this field made way for collaborative robots or cobots. Built to work safely in the same environment as humans, cobots have next-generation technology that makes them easy to learn and install (even for first-time robot users) and can be customised to handle a variety of applications in manufacturing, like painting, assembly, and machine tending.

COBOTS FOR SMOOTHER MANUFACTURING

Material handling is another huge application for cobots, primarily Autonomous Mobile Robots (AMRs), which are locomotive robot systems that can understand, process, and intelligently move around a factory floor. The predecessors of AMRs include manual carts and trolleys, which involve workers physically tugging them around the shop floor. These cause much physical strain to employees and also lead to supply chain inefficiencies due to wasted movement and fatigued workers. AMRs, thus, use artificial intelligence (AI), sensors, and wheels to independently

navigate the shopfloor to complete a multitude of material handling tasks such as lifting, trolley tugging, and sorting. They can also be used in creative applications such as delivering food in restaurants or transporting luggage in hotels. Even hospitals can make use of this technology to disinfect areas and transport food to patients, especially those with contagious illnesses. AMRs and other smart cobot solutions are not only countering labour shortages but also complementing existing human resources by being able to



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work in hazardous environments and handling tasks that may be monotonous, stressful, or dangerous.

The market for autonomous mobile robots in India is expected to attract nearly \$10 billion investments in the next five years. While traditional industrial robots mostly catered to large industries, the collaborative nature, fast installation, and space-saving features of cobots make them democratise automation so even SMBs (Small and Medium Businesses) can easily adopt robotic solutions. There are also an increasing number of Indian robotics solutions, which means manufacturers can use homegrown solutions. Some companies even provide Robotics-As-A-Service (RAAS), a financing option where a customer can essentially “rent” a robot for periods of time in case a permanent investment is not immediately possible. In addition to making robots more affordable, RAAS also enables businesses to experience the benefits of robots without putting a strain on finances.

COBOTS IN THE FUTURE

Contrary to popular belief, robotics doesn't necessarily correlate with unemployment. Rather, automation would provide millions of new job possibilities in the future. According to the World Economic Forum, approximately 97 million new jobs will be created

worldwide in the next five years, although upskilling and reskilling of the blue and white-collar workforce will have to be done at a rapid rate. Jobs like data analysts and scientists are gaining steam, as well as specialists in fields such as AI, machine learning, big data, digital marketing, process automation, and business development.

If there's anything the pandemic has taught us, it's how the world as we know it can transition virtually overnight. And that means people and businesses need to do their best to stay ahead. Robotics and other smart automation solutions can help do exactly this, enabling manufacturers to improve efficiency and quality intelligently while also helping them conquer labour shortages and complementing the existing workforce. Perhaps more importantly, robotics adoption will push the need to upskill employees as the nature of industrial occupations change and become more tech driven. Owing to the same, many companies have already recognised the need to upskill employees and are taking active measures to do so, empowering businesses and blue-collar workers to gain the expertise they need to face disruptions head-on. By using robotics, industrial automation enables leaner operation processes that require less energy, less material, and optimised human resources for a truly sustainable Aatmanirbhar Bharat. 



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FUTURE OF LASERS AND LASER PROTECTION TECHNOLOGY

With the booming innovation in laser technology, organisations must work with lasers and take advantage. The article elaborates on why understanding laser safety is paramount before working with it.



The advent of lasers has brought a revolution in global technology, owing to their multi-dimensional characteristic nature. The very fact that uncontrolled lasers, on the one hand, cause irreversible damage to the eyes but, if rightly controlled, are also capable of performing critical eye surgeries reveals the ability of lasers to operate in a broad range.

Over the years, the true potential of lasers has been realised through their expanding capabilities from high-end lab experiments such as optical tweezers and laser cooling of atoms to day-to-day operations, viz., laser barcode scanners and laser engravings. Lasers are used in many applications, from research and defence to medical instruments.

GROWING USE CASES OF LASERS

In the field of medicine, lasers are used to treat specific areas of tissues and complete cosmetic surgeries. In the manufacturing industry, lasers are used to cut through materials with high precision and are also used in additive manufacturing procedures to improve precision in 3D printing. Even in military operations, laser-based warfare is the advanced mode of attack adopted.

Lasers, unlike conventional light, possess high intensity, coherence, directionality and monochromaticity. They don't diverge with respect to the distance travelled, whereas conventional sources do. Thereby, the maximum power of the laser can be transferred over large distances. Hence, a large amount of ener-

gy is concentrated on the spot size and achieves high power densities.

As humans operate lasers, there are possibilities that reflections can damage vision permanently. Unintentional heat can vaporise skin tissue or cause retina lesions and skin burns. Therefore, reducing the laser intensity that enters the eye is vital. The severity of lasers can be imagined as a man can see a 100W tungsten bulb glow with little discomfort; however, laser light with <1W of power can damage vision without intimation.

As laser technology is growing and has adverse effects on humans, there is a high demand for laser safety equipment.

IN ALL FORMS & SHAPES

Lasers are classified into four types, 2M, 3R, 3B and 4 based on their power intensity. Laser protective eyewear and solutions are in high demand in the field of science and technological advancement. In conventional applications, three types of laser goggles are in use:

- Polycarbonate filters
- Absorption glass
- Dielectric filters and coatings

One form of laser protection is through laser safety coatings or filters done through thin film depositions. The filter deposited on the goggles blocks specific laser wavelengths and transmits the visible region of the electromagnetic spectrum through it (VLT-visible light transmission). Optical Density (OD) is the attenuation factor of a filter at a specific wavelength. For better understanding, 100 per cent, 10 per cent, 1 per cent, 0.1 per cent & 0.0001 per cent in transmission scale equals 0, 1, 2, 3 and 6 in OD scales, respectively, commonly used for denotation purposes.


Polycarbonate filters work from low to mid-power density lasers, and absorption glass reduces VLT. The dielectric filter or coating has an advantage over these two solutions by blocking specific laser wavelengths and transmitting visible light through them in the range from mid to high-power lasers. These filters can be designed per the laser's power and frequency. These filters undergo stringent quality control tests due to their direct relation to eye safety. The spectroscopic analysis gives the blocking ability of filters at wavelengths in the OD and VLT per cent scale.

Aerospace, automotive, electronics and semiconductors, medical, food and textile, construction, utility and other industries use different types of lasers, such as CO₂ lasers, fibre lasers, solid-state lasers, etc., for versatile applications like marking, micro-ma-



terials, and macro-materials with a wide range of laser power intensity. Global manufacturers of laser safety goggles are KCWW, Honeywell International Inc., 3M, Uvex group, W.W. Grainger, Inc., Phillips Safety Products, Thorlabs, Kentek Corp., Laser safety Industries, Global laser Ltd., VS eyewear, Univet, Trotec Laser GmbH, NoIR Laser Co., LLC, Laservision, Cole-Parmer Instrument Co., LLC, and Laser components. With a compound annual growth rate of 12.4 per cent, the Global industrial lasers market size is projected to rise from \$ 5.66 billion to \$14.52 billion from 2018 to 2026. The product has a great demand in recent years, as the market has exponentially grown in all fields. High throughput production facilities are required to support the increased demand for laser goggles.

THE FUTURE SCOPE OF LASER

In view of the future scope of laser applications, lasers will be a key contributor in many advanced fields, including sensors, digitisation, artificial intelligence to data encryption in quantum technology, to name a few. To start with, ultra-short high, intensity femtosecond laser pulses are the future of biomedical applications that will help both in imaging and conducting intricate, specific area targeted surgeries. With regards to electric vehicle (EV) manufacturing, laser welding makes it possible to achieve narrow and high-speed welding at a lower heat which is crucial in EV batteries. At the same time, self-driven cars employ laser-based scanning to map the targeted area in which the laser act as the eye of the car. In addition, the progress in the shrinkage in the size of semiconductor lasers, diode lasers, and several others widens the possibility of employing them in various intricate applications. In conclusion, with the explosion in the innovation of laser technology, to be able to work with lasers and take advantage, an understanding of laser safety is extremely important in the first place. 

“AUDI AIMS TO LAUNCH ONLY EVs FROM 2026, AND END ICE CAR PRODUCTION IN 2033”

With sustainable mobility gaining prominence, Audi plans to spear head the movement in India and globally. In conversation with **Balbir Singh Dhillon, Head, Audi India**, wherein, he discusses plan of action to become sustainable, the business of Audi India, their venture into the pre-owned vehicle segment and more. Excerpts...

by Anvita Pillai

COVID-19 has been a particularly tough period for the automotive industry in general. How did it fare for the luxury vehicle segment? Can you tell us a bit about the business for Audi India for the financial year that ended in March until this month?

COVID-19 impacted all businesses, including automotive. While we learnt to run our business efficiently via the digitalisation route, the luxury car industry operates in a different manner – where touch, feel and drive remain key to one's purchase.

Post-lockdowns, there has been an upward recovery with increased demand in the segment. It has contributed significantly to the revival of the luxury car segment. Audi India grew by 101 per cent in 2021. Taking the strong growth momentum forward, our sales have increased by 49 per cent in the first six months of 2022 over the same period last year. Audi India has retailed 1765 units in H1 2022. (January to June).


Two years ago, Audi took a call to stop diesel engine vehicles and focus entirely on petrol and electric cars. In fact, Audi plans to become electric altogether by 2033. Do you think India will have a much more EV-favourable market by then? Further, does Audi plan to establish its EV infrastructure soon? What strategy does the company plan to employ for the same?

There is a significant EV momentum as consumer perceptions about the viability of electric vehicles are changing. The Indian EV market has witnessed steady

traction in India, and we can confidently say that the EV market will continue to grow in the coming months and years. At Audi India, we have witnessed a fantastic demand for our e-Tron vehicles. We are currently the brand with the broadest EV portfolio in India, and the response to our five electric vehicles makes us believe that electric acceptance in the country will happen much faster than we anticipated.

In 2021, our management board announced a corporate strategy, 'Vorsprung 2030', which means a head start to 2030. More importantly, with this new strategy, Audi as a brand has announced a definitive timeline for the transition to electric mobility; this includes the launch of only EVs from 2026 onwards, the end of ICE-powered car production to end in 2033 and an increased focus on software and autonomous technology.

With regards to the EV infrastructure, it is vital for the rapid adoption of electric cars in the country. So far, we have installed 100+ chargers in India, including high-altitude locations of Leh. We are also installing chargers at our group brand dealerships located across strategic highways within the country to help expand the charging network. As a brand, we are also setting up high-speed chargers at our dealerships to ensure easy charging. Moreover, when we launched the Audi e-tron in India, we created an entire ecosystem for our customers. The Audi e-tron is sold with two chargers – a 22kW wall-box charger and a portable in-car charger.

A man with a beard and mustache, wearing a grey and blue checkered suit jacket over a white shirt and a brown belt, stands next to a dark green car. He is leaning his right hand on the hood of the car. The car has a prominent chrome grille and a large headlight. The background is dark with some vertical light patterns.

“Customers who know the merits of going electric are not hesitating to make the shift, and we are confident that the share of electric vehicles will continue to grow in the coming months”

In addition, we have an e-tron Hub section on the 'myAudi Connect App' that helps locate the nearest chargers en route. We are confident of the continued momentum and aim to achieve about 15 per cent of our EV sales by 2025-2026.

The launch of the Audi Q7 made a big wave in India. Have the sales of it surpassed your set expectations so far? Does not having a diesel variant in the vehicle deter the customer sentiments in any sense?

The Audi Q7 is a car loved by businessmen/women, Cricketers, Bollywood celebrities and even politicians. The Q7 is a very strong product in our portfolio and continues to witness good demand. We have a strong order bank for our cars.

With the automotive industry just starting to recuperate from the side effects of COVID-19, what do you think is the industry's biggest hurdle now? Can you also suggest solutions to overcome the limitations?

The chip shortage has hit the automotive sector and many other industries globally. But the biggest challenge which we face is uncertainty. In the luxury segment, the planning cycles are very long, and we have to plan from nine months to one year, even beyond. The waiting period on our models has improved significantly, and we are hopeful this continues in the months ahead.

"The high tax/duty structure and layering of one tax on another makes luxury cars very expensive in India and is the biggest impediment to the growth of this segment"

The industry needs a stable policy for the segment to grow. Taxations and duty structures make it difficult for the segment to expand. Currently, the import duty on fully imported cars ranges from 60-100 per cent, the GST (including cess) ranges from 48-50 per cent, and the registration/road tax is up to 20 per cent (varies from state to state). This high tax/duty structure and layering of one tax on another makes luxury cars very expensive in India and is the biggest impediment to the growth of this segment.

A re-look at the government's current tax structures will undoubtedly benefit the segment to grow considerably in the future.

Speaking specifically for the luxury vehicles segment in India, what challenges do you face in the Indian market?

The high import duties continue to remain a challenge for the luxury car segment in India. The share of luxury cars in the Indian market is hovering between 1-1.5 per cent and is restrained due to taxation.

How, in your experience, has the luxury car segment evolved in the last five years? How much-untapped potential does India's luxury vehicle segment possess? How is Audi working on "exploiting" it?

The luxury car segment in India is evolving quickly. There is a larger push towards electrification. More younger people, especially in the category of start-up owners, are keen on experiencing luxury at an early age. They have both the desire and means for it with increasing disposable income. We have also experienced the impact of COVID-19 in these past years but have quickly recovered from the setback. COVID-19 has further pushed people to live life to the fullest and adopt a luxury lifestyle if they can. It has also led to an increase in demand for pre-owned luxury vehicles. More and more people are purchasing second-hand Audis. To tap the potential in this segment, we have pushed our pre-owned luxury car programme – Audi Approved: plus.

Audi Approved: plus, Audi India's preowned car business, has consistently grown and continues to be an essential part of the brand's overall business strategy. We provide customers with a luxury car buying experience while purchasing a pre-owned luxury vehicle, which is unique in the market. We entered the pre-owned car business in 2012. In the last few years – the market has grown significantly and is headed towards further expansion. Audi doubled its pre-owned luxury car showrooms from seven to 14 in 2021, and the brand aims for 22 such facilities by the end of this year.

Between 2020 and 2021, Audi Approved: plus has grown by 39 per cent and has achieved 50 per cent growth within the first quarter of 2022 as compared to the first quarter of the last year. Audi India has increased the investments in Audi Approved: plus business by 30 per cent in 2021 vs 2020. There are more than 150 cars available on the Audi Approved: plus portal across the country.

Audi Approved: plus serves customers who cannot afford a new car but want to experience luxury. It is bridging the gap between potential customers and the brand. It offers two years of warranty, unlimited mileage, a service package, and the experience of buying a new luxury vehicle.



Audi launched five electric cars last year between July and September. What kind of acceptance have you experienced from the audience so far?

Exactly a year ago, we began our EV journey in India with the launch of the e-tron. Today, we are leading the luxury EV segment in India with five electric cars on offer and are the brand with the broadest EV portfolio in the country. The Audi e-tron 50, Audi e-tron 55, Audi e-tron Sportback 55, Audi e-tron GT and Audi RS e-tron GT – have received an overwhelming response, and we continue to have a strong order bank for these cars. Our first and second batch of vehicles were sold out even before they were brought to India – this tells you that there is a strong demand for luxury electric cars.

Customers who know the merits of going electric are not hesitating to make the shift, and we are confident that the share of electric vehicles will continue to grow in the coming months.

Audi launched its A8 L in the second week of July. What expectations do you have for it from the Indian market?


We have launched our flagship sedan – the new Audi A8 L in India. This car is the epitome of luxury and a popular choice among celebrities, businessmen/women. We expect strong sales volume and are

targeting a healthy share of our growth from this flagship sedan.

The luxury car segment in India is booming currently. What lies ahead for Audi business-wise this year?

We have retailed 1765 units in the January – June 2022 period, buoyed by new product introductions and continued demand for the Audi e-tron range, Audi Q5, Audi Q7, Audi A4, Audi A6 and S/RS models. Audi India recorded a robust 49 per cent growth over the same period last year.

We have recently announced segment-first initiatives to celebrate 15 glorious years in the country. We introduced a five-year warranty coverage with unlimited mileage for all cars sold this year, starting June 01, 2022. In addition, we launched Audi Club Rewards – a program that offers exclusive access, segment-first privileges and bespoke experiences to all existing owners (including Audi Approved: plus owners) and future customers of Audi India. We also launched our flagship – the new Audi A8 L, in India last week and are confident of its strong demand.

In India, we will continue expanding our pre-owned car business, Audi Approved: plus. Currently operating with sixteen Audi Approved: plus showrooms across all significant hubs in the country, Audi India is expanding rapidly. It will have 22 pre-owned car facilities by the end of 2022. 

By Philip HF Wallner, Industry Manager -Industrial Automation & Machinery industry, MathWorks
R Vijayalayan, Manager, Automotive Industry & Control Design Vertical Application
Engineering Teams, MathWorks India

VIRTUAL COMMISSIONING: ENTRY TO MODEL-BASED DESIGN & SPRINGBOARD TO SMART INDUSTRY

This two-part series elaborates on how, with the complexity of machine increasing, bidirectional exchange of data can improve functionality and flexibility for manufacturing production lines.

The complexity of machines and production lines is constantly increasing. Plant operators are demanding more and more functionality and flexibility for their production lines. They no longer want to manufacture a single product on it but to be able to offer customers a small series or even a one-off piece made to their specifications.

In addition, plants should be networked with each other, with the corporate infrastructure and the manufacturer. The bidirectional exchange of data should make processes more transparent and efficient, support operational planning and raw material ordering, and enable maintenance and updating of a machine's software and hardware with the shortest possible interruptions to operation.

The vision of plant engineering is, therefore, machines that undergo constant upgrades and updates during their life cycle, similar to what is already the case in the software sector. New requirements, changing market conditions and innovations should no longer be possible by replacing machines but rather by making partial changes to an existing plant fleet, thus making them more responsive, economical, and sustainable.

THE CHALLENGE

Integrating such capabilities into existing machines and their development processes poses a significant challenge for machine and plant manufacturers. Given the abundance of new requirements, it seems almost impossible to design such a transformation without deep ruptures.

Various other industries - such as the automotive, aircraft manufacturing or wind energy generation - have successfully introduced model-based development processes to solve similarly complex tasks. Although

they can serve as a model for mechanical engineering, a changeover takes time, expertise, and partners who can show the best way forward.

WHERE TO START?

A particularly suitable starting point for introducing models and for their economic use is first to carry out the commissioning of a machine virtually. For this purpose, a plant model is connected to the real control system and checks whether hardware and software behave as expected.

The benefits of this approach include testing with no material or energy consumption, no risk of damage to machinery, avoidance of penalties for time delays, and reduced travel and Accommodation costs for personnel. Moreover, the COVID pandemic, in particular, has shown that the ability to reduce the on-site presence to the necessary minimum can be of decisive importance for the feasibility of projects. This applies not only to commissioning but generally to all tasks that can be performed "remotely".



Philip HF Wallner



R Vijayalayan



Figure 1: Existing ways of mechanical simulation such as FEM and multi-body simulations are usefully extended by 3D simulation with game engines. © 1984 - 2022 The MathWorks, Inc.

Machine builders are often less familiar with modelling and may ask themselves whether the effort is worthwhile despite the mentioned advantages. The answer to this is a resounding yes, because getting started with modelling is only the beginning of consistently pursuing a strategy that promises successful management of the digital transformation toward a smart industry.

BUILD ON WHAT IS ALREADY THERE

Many of what plant engineers need to build such models are already available. For example, CAD descriptions of components can be imported directly into tools such as Simulink. With tools for multi-body simulations such as Simscape Multibody, these can be fully parameterised and then correctly reproduce the components' mechanical, electrical and hydraulic behaviour.

However, this approach is too computationally expensive for complete production lines and large-scale plants. In some places, therefore, approaches are already being pursued in which 3D models are built up in game engines from CAD descriptions and then used to visualise finished machines. One capability of game engines is to use the specialised computing power of graphics cards for precisely this purpose without developing new software.

The disadvantage, however, is that this is usually, on the one hand, an isolated solution separated from the development environment, and, on the other hand, game engines contain inherently limited physics

models but cannot realistically represent the actual dynamics of machines with their forces, moments, stiffnesses and friction values. Moreover, it requires developers or suppliers with specialised skills for importing and programming.

USE GAME ENGINES WITHOUT PROGRAMMING

For this reason, MathWorks has developed a new component for MATLAB and Simulink for three-dimensional animations with the Unreal Engine. It allows, for example, the simulation of large plants from many components by importing CAD models or those designed in Simscape, for instance. The equipment also includes a robot library with 45 common industrial robots, further facilitating the start.

The user can create and control the simulation using MATLAB scripts, query states and change parameters during runtime. Programming experience with game engines is not necessary. All objects can be parameterised, so their behaviour is determined by physically plausible or possible variables and collisions (Fig. 1).

In addition, as in physics-based computer games, external forces acting on objects such as workpieces are calculated in this environment. For example, after selecting a coordinate system, dropped objects are subject to gravity, centrifugal forces and friction. For example, a workpiece transported on a chute slides or rolls down naturally and arranges itself between the pieces already in a container (Fig. 2).

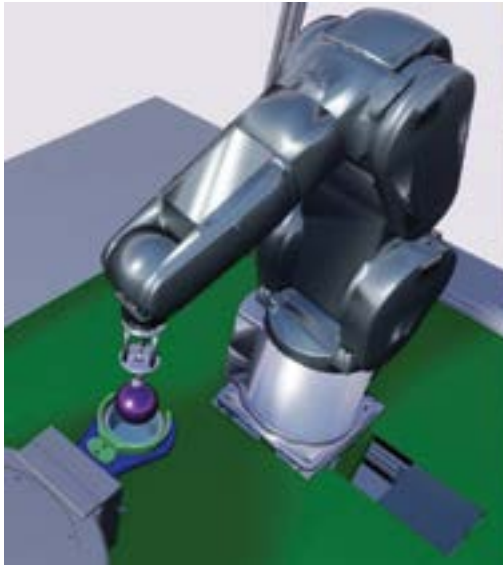


Figure 2: A ball is dropped into a cup by the handling robot (left); the cup with the ball slides into the collection container at the end (right). Objects in free motion behave in a physically plausible way. © 1984 - 2022 The MathWorks, Inc.

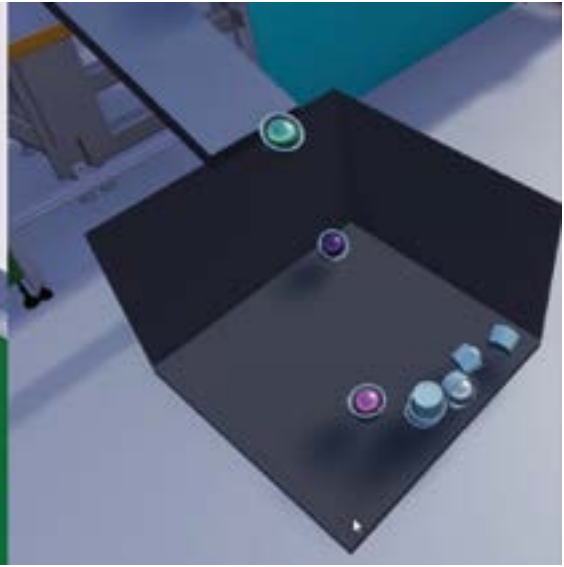


Figure 3: Control code generated with Simulink PLC Coder. © 1984 - 2022 The MathWorks, Inc.

This allows valuable insights that would otherwise only be available on the physical machine.

EXPLOITING THE FULL POTENTIAL

However, the full added value of models can only be achieved if they are used consistently over the entire life cycle of a plant. For this reason, virtual commissioning, in which experience can be gained based on existing resources, is an ideal opportunity to get started. From here, one can work one step at a time towards continuous use without completely overturning established processes.


Automotive and aircraft manufacturers have been working with models from the beginning of the development process for quite some time. This allows initial simulations of the control system to be carried out against a plant model or with simulated inputs right at the start of the development process. Mechanics, electronics, hydraulics, pneumatics and software are thus developed and refined simultaneously and hand in hand. Starting with a rough model linked to the requirements, the functions of the control system are worked out in increasing detail. Testing and verification of the algorithms can thus also begin virtually on the first day.

The modularity of such models brings decisive advantages. First, algorithms, logic and modules that have already been built and verified can be reused from earlier projects. Second, it is precisely this modularity

that makes continuously updatable machines possible at all. New functionality can either be built into existing modules or developed as a new module and inserted into an existing model. Previously proven functionality can continue to be used with confidence that it will work as desired.

Afterwards, simulations with test cases can be carried out again without having to build new parts for the machine or write code for a control system, for example. This not only saves time and costs but also promotes innovativeness. One can play with alternative solutions and thus generate and offer more and better functions and capabilities.

The third advantage of model-based development concerns the implementation of the controller and its integration with the hardware. With suitable tools such as MATLAB and Simulink, code for various control platforms can be generated automatically from models. The choices are C, C++, Structured Text or Ladder Diagram according to IEC 61131 (Fig. 3), but also HDL.

Machine builders who operate in different markets around the world are often confronted with the fact that different control manufacturers are preferred in each case. Since the models are platform-independent, code for these different controller types can be generated from them without additional effort. Necessary parameterisations for the requirements of a specific PLC are set by clicking on the appropriate manufacturer type. 

By Dr Karthik Sundarraj, Technology Advisor (To MD) – Special Projects Technical & Business Development – Electronics, Life Sciences & CFD, Hexagon

MANAGING THERMAL RUNAWAY TO ADDRESS EV BATTERY FIRES

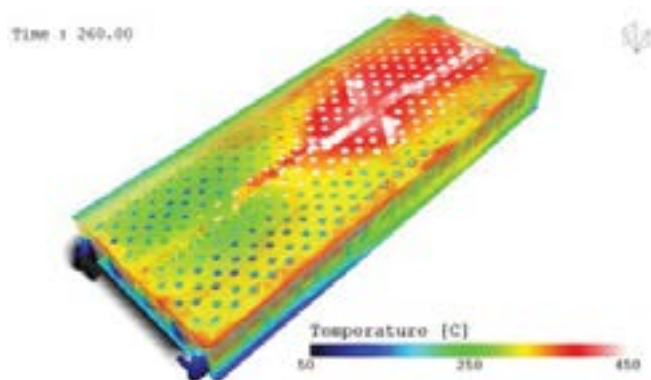
With EVs catching fire, it is important to understand why it is happening so rampantly. Read to understand why managing thermal runaway is crucial to EV growth in India and reducing fire incidents.

As India works to fulfil its pledge to reduce its carbon emissions to net-zero by the year 2070, reducing reliance on fossil fuels has been an important goal. To this end, India is aggressively promoting the adoption of Electric Vehicles (EVs), intending to switch 30 per cent of private cars, 70 per cent of commercial vehicles, and 80 per cent of two and three-wheelers to electric by the year 2030. While adoption is picking up, recent incidents of EV batteries catching fire have led to considerable fear and reluctance to invest in EVs. The government has introduced incentives for manufacturers and end-users to encourage EV adoption. To eliminate battery fires, it is essential to understand the concept of thermal runaway, which is the leading cause of battery fires.

WHAT IS THERMAL RUNAWAY?

Thermal runaway in a battery results from a chain reaction of one exothermal process, which triggers other processes resulting in an unstoppable reaction. When the temperature inside the battery reaches a point, an electrochemical reaction occurs, leading to an uncontrollable temperature increase. In simple terms, if the temperature reaches the critical point, the battery begins to release energy which accelerates the rise in temperature further.

During thermal runaway, temperatures in the battery increase within milliseconds. The energy stored in that battery is suddenly released, producing a very high temperature of around 400° C. These temperatures can cause the battery to release gas, and catch nearly impossible to extinguish the fire. In some batteries (for example, lithium-ion batteries), thermal runaway causes the battery to explode, making prevention of such failures critical.



CFD Simulation of a Thermal Runaway in a battery

features that enable 1D post-processing and network representation, giving a pragmatic view of such battery phenomena. Such results are easily quantifiable.

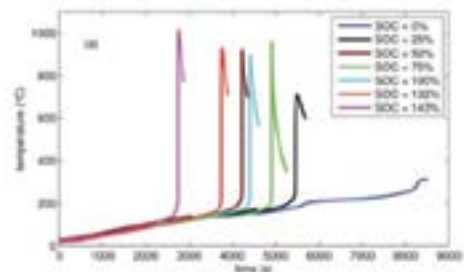
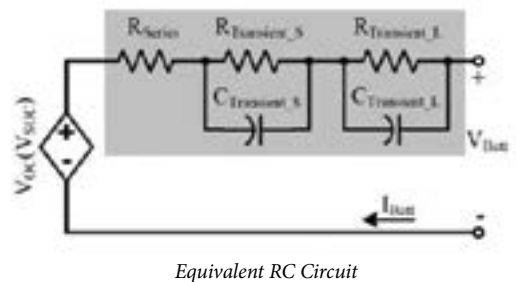
Researchers have created a dual-purpose cooling plate for prismatic lithium-ion batteries (LIBs) to improve battery pack life and safety for use in vehicles, aircraft, and stationary electric storage systems for grid and renewables. The cooling plate can effectively control and dissipate the generated heat during thermal runaway to prevent heat propagation from one cell to the adjacent cells in the battery pack, thereby increasing battery life, and can effectively control and dissipate the generated heat during thermal runaway to prevent heat propagation from one cell to the adjacent cells in the battery pack, thereby increasing safety.

During normal operation, this cooling plate can keep the battery temperature below 25° C, whereas, during thermal runaway, this cooling plate can keep the battery at 75° C for 30 seconds. Also, during normal operation, the coolant pressure drop in the cooling plate is 75 Pa, whereas, during thermal runaway, the coolant pressure drop in the cooling plate is 54 kPa. CFD simulations performed to test such cooling plates can effectively avoid repetitive design changes in the prototype.

An RC Equivalent Circuit Model feature enables the representation of the behaviour of the sub-cell domain in terms of non-instantaneous response. A battery is modelled with an equivalent circuit consisting of capacitors and resistors to fit the decay curve for voltage with exponential functions when there is a non-instantaneous voltage response against electric current. In this model, each resistance and capacitance is defined as a function of the state of charge. This enables the representation of voltage with SOC.

As such, numerical simulations have also shown that cooling systems, such as heat pipe cooling systems, cannot remove thermal runaway in a single battery but can prevent the propagation of thermal runaway to the other batteries. The simulation tool predicted the thermal environment that balances cell internal heat release and decomposition kinetics. It allows for exploring some parameter space and identifies heat-dissipation strategy sensitivities, insulation, ventilation, and so on.

CFD simulations have also been performed on developing a coupled electro-thermal runaway model, implemented using finite element methods based on the electrochemical and thermal models. Furthermore, by varying the spacing of adjacent cells, the solder joint area, and the cross-sectional area of the




Graph of temperature vs time during thermal runaway

electrode tab, the characteristics of different modes of heat transfer of each cell during thermal runaway propagation of the battery module in an open environment can be studied. With the increase of cell spacing, the heat transfer capacity of the three heat transfer modes decreases for all cells.

CFD has demonstrated the successful simulation of thermal runaway, which can be avoided by using heat sinks that limit the temperature rise, protecting the transistor. Based on the results of the heat transfer path, heat radiation effect, and the bottleneck, CFD simulations can effectively proceed with the thermal design. Also, the software demonstrated the simulations of heat sinks and fins, which gives a visual understanding of ways to avoid such phenomena. Proper storage temperature, proper ventilation, and prevention of overcharging can help prevent thermal runaway at its early stage.

SIMULATION ENHANCING AUTOMOTIVE INDUSTRY

Thermal runaway in batteries is a significant financial risk as well as a barrier to consumer acceptance, which has become a significant issue in the emerging electric vehicles industry. Cradle CFD offers the best simulation platform to avoid such problems as well as reduce the computation cost and time for testing. 

By Naveen Mehta, President – Operations, Jindal Aluminium

THE ROLE OF GREEN ALUMINIUM IN GLOBAL SUPPLY CHAINS

With aluminium being among the most widely used metal, sustainability needs to be a priority. The article elaborates on the need for innovation within the sector for a greener future.

Aluminium is inevitable for a resilient, efficient and sustainable global supply chain which strives to achieve an optimum level of movement of goods. While being cost-efficient, quick and flexible, it incorporates a management process that binds together a network of suppliers, manufacturers and warehouses, and means of transportation. And if there is one metal that is inevitable to have a robust, effective, and sustainable supply chain spanned across the world, it is aluminium.

It goes without saying that if the world is to meet the ever-growing demand of its increasing population, aluminium, the 'green metal,' has a competitive advantage today & will be imperative tomorrow in the global supply chain.



Naveen Mehta

ENDLESS POSSIBILITIES WITH ALUMINIUM

From construction to planes, household appliances to the packaging of foods and beverages, the fundamental properties of aluminium, such as its design, strength-to-weight ratio, infinite recyclability, sustainability, high corrosion resistance, and supreme formability, provide endless possibilities. They make this green metal the future metal for a more sustainable world.

ALUMINIUM IN ROAD TRANSPORTATION

Transportation accounts for about 20 per cent of the world's energy demand. Aluminium components in an articulated truck can reduce the vehicle's weight by up to 2,000 kg. Owing to the property of its strength-to-weight ratio, an aluminium-intensive truck can carry a heavier load with exceeding statutory weight limits. Decreasing the weight of vehicles leads to improved fuel efficiency, reducing energy consumption and greenhouse gas emission. Compared to steel, aluminium can reduce the weight of a vehicle by 40 per cent without compromising strength. The benefits of aluminium in transport go beyond this to cover enhanced performance, easier handling and reduced wear on roads.

INCREASING COMMERCE WITH ALUMINIUM: FREIGHT CONTAINERS

Freight containers in the global supply chain connect the global economy. It is estimated that more than 80 per cent of global goods are transported across the sea. The strength, lightweight and durability of aluminium make it a beneficial and economical material for constructing freight containers. In the case of shipping containers, too, the use of aluminium over traditional materials such as steel has the potential to increase payloads while reducing





the weight and, in turn, the overall transportation costs, making business a profitable affair. In addition, aluminium has also proven to be an effective material for the construction of cargo holds, including insulated holds, as it is non-reactive and non-abrasive.

ALUMINIUM IN A SEA VESSEL

Since the first all-aluminium seagoing vessel was built in 1892 in France, aluminium, over 120 years, is still the most preferred material in the maritime supply chain due to its lightweight and ease of fabrication along with corrosion and corrosion and fatigue resistance. Aluminium's superlative properties allow vessel volume and height to be increased without loss of stability. Further, the aluminium claddings of the interiors are attractive and easy to clean. Along with low maintenance cost, there have been reports that over 30-years-old aluminium crafts show no signs of metal fatigue. Compared with their steel counterparts, using aluminium in the global supply chain can increase the speed and size of the vessels while improving their fuel economy, safety, reliability and costs.

AIRCRAFT: BRINGING WORLD ECONOMIES CLOSER

From the Wright brothers' first aeroplane with a 30-pound aluminium block to reduce weight to building the first all-aluminium plane in the early 1920s, the world has relied on aluminium to achieve efficiency and take off. The International Air Transport Association estimates that air cargo has been used to transport a whopping \$6 trillion worth of goods annually, representing 35 per cent of all global trade by value. As the primary aircraft material, aluminium comprises about 80 per cent of an aircraft's unladen weight. Aluminium's combination of lightness, workability and strength makes it the ideal metal for making commercial aircraft. Strong aluminium alloys take extraordinary pressure and stress related to high-altitude fly-

ing, reduce the weight and therefore save fuel and increase the aircraft's payload.


MODERN WAREHOUSES

As a result of its properties, aluminium makes it the most popular raw material for creating modern and reliable solutions. The metal can take almost any shape. Thus in warehouses that play a pivotal role in the overall supply chain, aluminium can be easily moulded to produce complex elements like an individually designed grid system, modules, shelves and platforms. In addition, as aluminium is ideally suited to anodizing, it becomes even more resistant to wear and scratching. In the case of aluminium roofing, it is non-flammable, aesthetically pleasing, easily installable and environment friendly. These properties make the metal an excellent choice for upgrading and constructing modern warehouses.

ALUMINIUM PACKAGING

Aluminium is a malleable metal. It can take any form and shape, and its protective qualities have made it the most versatile packaging material in the world. It is also by far the lightest packaging material. Aluminium packaging offers a high level of corrosion resistance, an impermeable metal barrier to light, ultra-violet rays, water vapour, oils and fats, oxygen and micro-organisms. In the case of packaging sensitive products such as pharmaceuticals or food, the metal is hygienic, non-toxic and non-tainting. The aluminium packaging also plays an essential role in keeping the contents fresh, guaranteeing a long shelf-life.

IN CONCLUSION

The world needs to continue its quest to bring innovation and cutting-edge technology to improve aluminium applications and processes, use less energy, cut climate emissions and uplift the global supply chain to meet its commercial and sustainability goals. 

By Surender Narula, President, Nexcharge

WHY LOCALISING EV SUPPLY CHAINS IN INDIA IS CRITICAL

With electric vehicles being promoted in India on a large scale, it is essential to establish local supply chains which take care of everything from manufacturing to scrapping. Read to know how this can help India get an advantage on a global level.

EV sales are surging to unprecedented levels. Estimates have pegged the market opportunity for the electric vehicles sector in India to be worth approximately \$206 billion by 2030. Despite accounting for less than 1 per cent of total car sales, the number of electric vehicle registrations is steadily increasing, with over 50,000 new vehicles being registered every month. Furthermore, a new competitor enters the market almost every month with a brand-new product. However, the question that needs to be raised is whether or not our nation is moving toward the goal of localising the EV supply chain.

The lithium-ion batteries that power electric vehicles are made up of cells, packs, and BMS (Battery management system). India presently imports practically all of its lithium-ion battery cell supplies. Depending on range and performance, batteries account for 25–50 per cent of the entire cost of an electric vehicle. The price of owning an electric vehicle won't start to drop until we localise the manufacturing of electric motors and batteries. However, the cost and availability of lithium and cobalt, as well as waste management, are some impediments to an electric car ecosystem.

INDIA'S AUTOMOTIVE HISTORY

India has long been known as a global software development hub for the automotive industry, producing code for companies like Mercedes-Benz, General Motors, and Ford. These domestic capacities may be useful in addressing real-world EV safety, battery charging, and range management issues. Additionally, through automation and blockchain,



Surender Narula

India's software companies may assist EV producers in better managing their supply chains.

India's burgeoning EV mobility industry, notably in the two- and three-wheeler segments, presents a substantial opportunity for the country's road transportation sector to transition to a low-carbon route. Significantly, spill-over benefits have the potential to increase job creation,

reduce local air pollution, and reduce petroleum dependence. These opportunities, however, will only materialise if policymakers and stakeholders in India's electric vehicle sector shift their focus to establishing local, more resilient supply chains.

MAKING AN EV IN INDIA

EV parts, like the battery cells, chassis and body, motor, BMS, and power electronics, can be classified into five to six categories. Over half of the total EV cost is attributed to battery cells, motors, and power electronics. As mentioned above, the components have the lowest localisation level, which is a frightening reality. Batteries are still the most important part of the supply chain, whether it's for electric two-wheelers, three-wheelers, four-wheelers, buses, off-highway, etc. Atmanirbhar Bharat and Make in India are two programmes that encourage localising the supply chain, which could help the EV industry become less reliant on imports.

Lithium-ion is expected to remain the major EV-battery technology till at least 2030. Key components of the li-ion battery metals are aluminium, copper, nickel, cobalt, and of course, lithium. Among the most significant obstacles confronting the EV supply chain is the limited availability of

raw materials like lithium, nickel and cobalt, inadequate R&D and technological intervention, rare earth material magnets for motors, and power electronics. Lithium is required in all cathode materials irrespective of the chemistry. Depending on the anode chemistry, Graphite (Gr) or Titanium (Ti) are required materials. The Li requirement ranges from 80-120 tons for 1 GWh of cell manufacturing for all mentioned chemistries. Cobalt supply is seen as a high-risk material due to quasi-single-country exposure (DRC producing ~65 per cent of global cobalt) and the emergence of companies that started to 'corner' the market by physically storing refined production volumes – current (artificially inflated) prices, however likely to drop. India has very limited known reserves of lithium, whereas, in the case of nickel and cobalt, the country's entire demand is met through import. Therefore, the Indian EV supply chain ecosystem would benefit from measures such as increased investment in battery R&D and focusing on recycling. Trade agreements can be done with different countries for raw materials to ensure continuous supply and economic advancement.

THE DOMINANCE OF CHINA

Despite the emphasis on promoting local manufacture of battery cells, import dependency will persist due to the normal lead time for battery cell production of at least two years. Meanwhile, EV manufacturers are concerned due to a rise in worldwide pricing and China's sustained dominance in battery cell production. The global capacity for producing lithium-ion batteries in 2020 was estimated to be 540 GWh, and according to a report by NITI Ayog, more than three-fourths of that capacity was located in China. The United States held 8 per cent of the total worldwide Li-ion production capacity that year, while the European Union held just 7 per cent.

China will continue to account for two-thirds of the world's lithium-ion battery capacity even in 2025 when it is anticipated that the worldwide capacity will nearly quadruple to 2015 GWh. As a result, it is

abundantly evident that India is currently helpless in the face of an increase in the price of batteries due to its dependence on imports. This status is not expected to alter in the near future until domestic capacities are brought online.

GOVERNMENT PUSH FOR LOCALISATION

The Centre recently authorised the Production Linked Incentive (PLI) Scheme 'National Programme on Advanced Chemistry Cell Battery Storage'. The Rs18,100 crore project will stimulate the development of 50 GWh of advanced cell chemistry and 5 GWh of niche cell chemistry production. The scheme describes an ambitious aim to enhance advanced chemical cell production, but there may be barriers. Advanced Li-ion chemistry cells use Lithium (Li), Nickel (Ni) and Cobalt (Co). As we get toward electric vehicles, demand for these metals will climb sharply. According to Benchmark, Li's cost tripled, and Co's cost quadrupled in recent years. According to German experts, even the most optimistic scenario predicts a shortage of these metals by 2023. In this case, advanced chemistry cell production costs will rise. Another obstacle is the disposal of spent batteries. With the recent push toward electric vehicles and the PLI scheme, advanced cell battery output is projected to rise in the future years. JMK Research predicts India's yearly lithium-ion battery industry will expand 37.5 per cent to 132 GWh by 2030. If current trends continue, a huge number of advanced cell batteries will





reach the end of their useful lives in the next 20-25 years. As a result, it's time to start planning for the future, when improved chemical cells are projected to become more prevalent in waste streams.

Urban mining can help us overcome these difficulties. It recovers precious metals from batteries and keeps them out of landfills. Urban mining can be beneficial for the economy and the environment. Closed-loop recycling of lithium-ion batteries might save up to 50 per cent of the natural resources needed to make virgin materials. It also can potentially reduce the impact of mining on the environment. Urban mining is enticing but has downsides. Collecting and classifying Lithium-ion batteries, differing battery chemistries, and cost are challenges to recycling.


Extended Producers Responsibility (2020) guidelines could assist in collecting and sorting battery waste. EPR can improve the collection, transportation, and battery chemistry. A fund that subsidises initial recycling costs can help scale up the operation. According to the Huazhong University of Science and Technology study, a closed-loop supply chain that includes battery recycling boosts electric vehicle production. When recycling complex battery chemistries, we don't start over. Lead-acid battery recycling has had chances and challenges. This experience must be used to im-

prove battery recycling. We must work in a closed-loop, not silos. We want advanced cells. Because resources are finite, we must increase sophisticated cell recycling.

KEY TAKEAWAY

After China, the United States, and Japan, India is the world's fourth-largest passenger vehicle market. Furthermore, it is also the biggest market for two-wheelers and three-wheelers. As a result, India will play a critical role in the quest for EVs in the shifting global order. EV firms and component makers in India will benefit greatly from the opportunity to encourage EV adoption.

India is a significant market for automotive use, and increasing local EV manufacture will reduce reliance on fossil fuels and kickstart a global shift to sustainable energy. The current Indian EV production ecosystem is heavily reliant on imported EV components. However, price disparities, a lack of charging infrastructure and an EV ecosystem that allows for easy production, sourcing, and financing all impede the adoption of EVs in India.

Over the next decade or so, the focus will be on import substitution, localisation, and self-reliance as the road to large-scale EV manufacture unfolds. Indigenising EV technology will lower ownership costs and expand EV use. 

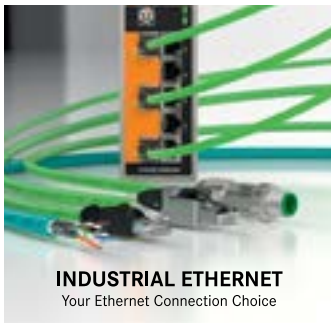
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THE RIGHT TOOL FOR CNC TECHNOLOGY

In a smart metalworking factory, there is information exchange between the real world of CNC machines and a virtual world that functions according to the features of the machined parts and their respective theoretical characteristics. Smart balancing on the boundaries of these worlds and analysing the real-time information contributes to decisions and corrections made by computer-controlled units.

The element, which is much smaller, substantially cheaper, and considerably less complicated when compared to a CNC machine, is a cutting tool which is the link that directly removes material from a workpiece and closes the process of “machine-workpiece”. Due to objective reasons, this element is subjected to less fundamental changes and frequently identifies the cutting tool as the weakest link in the processes, which also limits system capabilities. Therefore, appropriate upgrading of cutting tools should be considered an integral part of the progress of CNC technology.

A conventional approach to making cutting tools relates to designing innovative cutting geometries, using advanced cutting materials, and applying leading production technologies intended to improve tool life, ensure greater material removal rate (MRR), provide higher accuracy, and increase reliability. Nevertheless, Industry 4.0 trends in the development of CNC technology prioritise the digital component of a cutting tool.

Information has constantly accompanied cutting tools even before Industry 4.0 catalogue data, tool drawings, and recommendations regarding applications were provided in printed formats and later as electronic formats and continue to be essential for metalworking. Computerisation has affected customer support by providing expanded capabilities in the form of data. Various software applications have enabled selecting optimal tools and estimating tool life under specific machining conditions. The combination of Iscar's NEO-ITA and power consumption applications enable quick calculation of cutting forces, bending load, power consumption, finding suitable cutting material grade, the right tool for a specific application, and analysing competitors' products alongside other useful functions. Customers can easily access data and related information using computers and mobile devices. Notwithstanding, advancements in network communications have introduced the world of metal cutting to the virtual electronic world.

Digital twin technologies complement manufacturing processes.

Machining modelling, collision checking, and process optimising to find the best cutting strategies are only some examples. In a smart factory, the digital twin is the most significant brick of the foundation. Understandably, only a tool having its digital twin is acceptable for the

smart factory's toolroom.

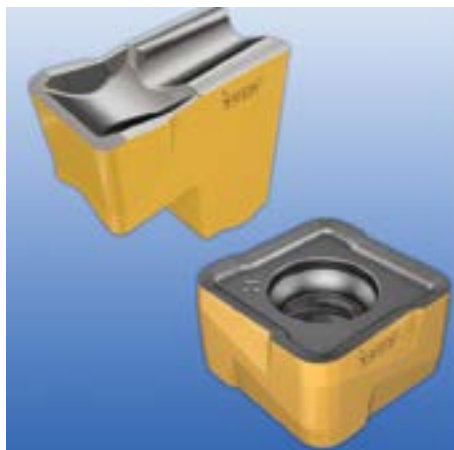
The progress of CNC technology leads to new demands for cutting tools. A tool producer is expected to be a product provider that ideally combines a tool as a material object, its real-time digital twin, and an appropriate software environment. This allows the seamless incorporation of the tool data in CAD/CAM and virtual manufacturing, direct transmitting by the Internet of Things (IoT) networks - tool packages and virtual assemblies.

To make tool representation clear for various computer systems, the ISO 13399 standard was developed and assured the platform's independence. This standardisation is necessary for other digital components of the tool package to unify data related to tool life, calculated loads, machining conditions, etc.

ISCAR's digital tool component, based on the ISO 13399 standard, includes the following characteristics.

- E-catalogue with various search functions, updated promotion information and reference data.
- The .p21 file (a STEP file) includes a product identification class for a comprehensive tool for data representation and exchange.
- 3D tool representation for computer modelling and CNC programming in accordance with the ISO 10303 standard (STEP).
- A 2D tool representation in DXF format for planned process documentation, drawings, tool layouts and setup sheets.
- Virtual tool assembly options for turning, milling and holmaking tools intended for generated digital assembly twins in both 3D and 2D representations.
- NEOITA – ISCAR Tool Adviser, an expert system that recommends optimal tooling solutions for a specific application.
- The machining calculator and the cutting material grade optimiser software applications.

A rapid pace of industrial digitising takes CNC technologies to new heights. This boost appropriate changes in the product range of a tool manufacturer and demands strong links between a cutting tool and its virtual digital component.



WALTER INTRODUCES HELITRONIC DIAMOND EVOLUTION

The new super-compact erosion and grinding machine featuring the 'two-in-one' principle from Walter is specially designed for the production and regrinding of PCD tools with diameters of up to 165 mm and lengths of up to 185 mm (end face operation) and/or 255 mm (outer diameter operation). With a minimum space requirement of only 4.2 m², the Helitronic Diamond Evolution can be used to erode and/or grind PCD tools, including shank, profile, circular and roll millers, multi-step tools and countersinks, as well as cutting and profile cutting plates.

With a drive output of 9 kW, the Helitronic Diamond Evolution offers one of the market's most powerful grinding spindle drives. As is the case for other 'two-in-one' eroding and grinding machines from Walter, the Helitronic Diamond Evolution is equipped with Diamond-Plus as standard for an optimised cutting edge and processing time.

The Helitronic Diamond Evolution is also available with a robot loader for a maximum of 72 HSK tools or 7,500 cylindrical tools (diameter-dependent) – the perfect solution for loading with reduced staff levels.

The aviation and space industry and the automotive sector focus on lightweight yet durable materials, such as high-strength aluminium and carbon fibre-reinforced plastics. Tools with tough blades made of polycrystalline diamond (PCD) and complex geometries are required for machining such materials. There is a clear trend within the PCD market.

With the development of the Helitronic Diamond Evolution, Walter has now found the ideal solution: a machine that requires a minimum of floor space and offers optimal value for money, which can erode and also efficiently grind carbides, and includes a powerful and flexible software package that is ideally suited for the production of the most common types of PCD tools.

The internationally proven Helitronic Tool Studio grinding software was adapted and expanded for eroding operations. 3D live simulation, collision checking and operations such as K-Land and variable spirals are just a few examples of the new flexible features available for PCD tool programming.



DRYLIN® T: COST-EFFECTIVE LUBRICATION-FREE ALTERNATIVE TO RECIRCULATING BALL BEARINGS

Who likes to have greasy hands? You might know this from your children. They quickly eat a few fries and then wipe their greasy fingers on the T-shirt. Nobody likes to have greasy fingers or grease stains on their clothes. If you work with machine elements such as ball bearings, gears or linear guides, it is almost impossible to avoid this contamination, isn't it?

The fact is that all movements of metal on metal must be provided with a lubricating layer. Oils or greases are used for this purpose. If these are not present or are not relubricated regularly, the system will fail.

Grease thus ensures the function of a metallic bearing but can also be extremely troublesome in many applications. Have you ever seen a bearing getting corroded/getting failed because of inadequate lubrication or recirculating ball damaging the rails or shafts?

Isn't it a big worry for all engineers to find a solution to these problems?

You would love to know that drylin linear bearing has already resolved millions of existing conventional bearing problems like corrosion, Noise, Weight

reduction and many more. It is also 1:1 interchangeable with conventional recirculating bearing.

Let's see the working of igus' drylin linear bearing.

drylin® T slides instead of roll

The igus drylin® linear bearings enable maintenance-free and lubrication-free operation of parts of machines and equipment whose function is determined by relative movements in a straight line between components. The special dry-tech® high-performance plastics of the bearing bushings ensure machine elements can be moved along a shaft or profile guide silently and with little friction. Compared to linear solutions with rolling elements, the acquisition costs are up to 40 per cent lower, and there are no additional operating costs.

One or several rows of balls support the shaft in linear ball bearings. To work properly, they need a ball recirculation system that guides the balls back in the direction opposite to the shaft's direction of movement. The ball recirculation system and the high-stress level on the balls due to the load being applied



to a small point on each ball result in potential weak spots and noise. Recirculating ball systems can be replaced with igus® linear bearings of the drylin® series in nearly all areas of use. Due to their simple structure, the drylin® linear plain bearings have very little susceptibility to failure. Lubrication-free operation means that the machine parts remain free of dirt, dust and moisture. Another advantage is the very quiet operation of the drylin® linear bearings.

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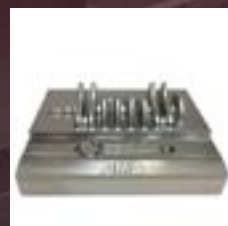
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