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The Official Magazine of

Indian Machine Tool Manufacturers' Association

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Modern Machine Shop

WORKING IN TANDEM

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19 - 25 January 2023, Bengaluru

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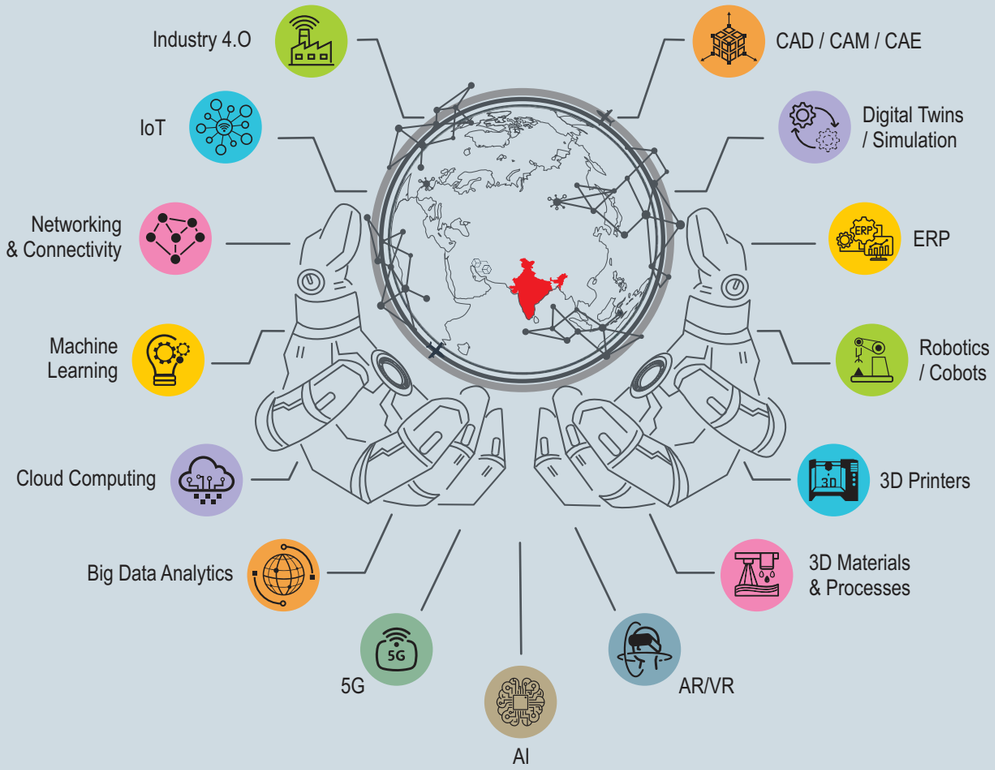

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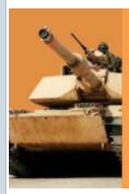

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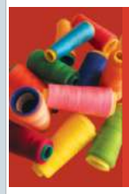

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ASPIRING FOR GROWTH

Source: BFW

RAVI RAGHAVAN
PRESIDENT
INDIAN MACHINE TOOL MANUFACTURERS' ASSOCIATION (IMTMA)

Once again, I am glad to connect with the readers of Modern Manufacturing India (MMI) magazine.

Going by the recent trends, the Machine Tool industry in India is experiencing a decent run in production, consumption, and exports. Order booking for the forthcoming quarters looks promising.

Machine tools are once again drawing increasing attention from manufacturing businesses. Thus, manufacturing growth aspirations will only be realized when machine tools offer superior performance and features that can cater to the needs of multiple sectors. Indian manufacturers of machine tools can compete with national and international peers by embedding new technologies, higher speed-efficiency-and-precision, and features that support end-to-end solutions with integrated services.

More than 850 exhibitors have registered for IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023, which is scheduled from January 19-25, 2023, at Bangalore International Exhibition Centre (BIEC) in Bengaluru. It is heartening to see a good response from the machine tool fraternity after the exhibition's four-year hiatus.

> *To improve the export orientation and global competitiveness of Indian machine tool manufacturers, it will be paramount to increase their participation in various global exhibitions like IMTEX, which will not only help to improve India's image but also enhance business growth by several notches.*

IMTEX is one of the world's important trade fairs for the Machine Tool industry as it provides a platform to present innovations, cultivate contacts, and drive business goals. Hence, I urge the manufacturing community to participate in IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023, get acquainted with the latest technology trends and high-value products, and set the ball rolling for enhanced manufacturing growth.

I hope to see you all at IMTEX 2023.

Happy reading.

JIBAK DASGUPTA
DIRECTOR GENERAL & CEO
INDIAN MACHINE TOOL
MANUFACTURERS' ASSOCIATION

Dear Readers,

There's a lot of positive momentum building up for the Indian Machine Tool industry right now with healthy order booking for the coming quarters. The coming months will be busy for the Indian Machine Tool Manufacturers' Association (IMTMA) as it prepares for IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023.

The exhibition, the 20th in the series, at Bangalore International Exhibition Centre (BIEC) from January 19 - 25, 2023, will bring everyone together — the builders of machine tools, the user industries, the supply chain, and the policymakers from various nations — to discuss, explore opportunities, forge deals, and find solutions to challenges.

Along with monitoring the ever-changing needs of market and business conditions through shows like IMTEX, there is another aspect on which we shall focus our attention, which is the periodic and methodical capturing and analysis of industry/business data.

I am already excited to be part of IMTEX 2023 at its full strength post my joining IMTMA and closely observe the revival of the pent-up demand and excitement from an insider perspective.

Along with monitoring the ever-changing needs of market and business conditions through shows like IMTEX, there is another aspect on which we shall focus our attention, which is the periodic and methodical capturing and analysis of industry/business data. IMTMA, through its customer-centric data-based analytical reports, will continue to serve its membership, as well as the manufacturing fraternity nationally and globally.

In this edition of Modern Manufacturing India (MMI) magazine, readers will find more information on IMTEX 2023. I look forward to seeing many of you there.

SOUMI MITRA
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AIM FOR THE MOON. IF YOU MISS, YOU MAY HIT A STAR!

Recently, Skyrocket Aerospace, a Hyderabad-based Indian startup, founded by former Indian Space Research Organization (ISRO) engineers, created history in the Indian space sector. For the first time, a home-grown company manufactured a launch vehicle Vikram-S that carried three payloads and stepped into commercial space exploration.

The rocket is named after Vikram Sarabhai, the father of India's space program. Vikram-S is a six-meter-long rocket, developed in a span of two years and made of an all-carbon fiber core structure, and weighs 546 kg. It is a single-stage, spin-stabilized solid-propellant rocket with a mass of around 550 kg. The rocket is said to have reached a peak altitude of 55.6 miles, which is higher than NASA's designated Earth-space boundary of 50 miles.

To date, the national space agency ISRO has been responsible for developing, designing, and launching rockets, space explorations, and missions. Skyroot Aerospace paved the way for private companies to enter this domain with its maiden 'Prarambh' mission. It marked a new era of the private sector being capable of not only developing and designing these launch vehicles but also attracting customers and investments into the sector.

It is slated that the startup entity received a total funding of $68 million, including $17 million raised through a seed round, Series A and a bridge round, and $51 million in a Series B round.

Never before has the Indian space sector attracted such huge investments. As per reports, in the year 2022, funding to private space sector players has witnessed an increase of 61.5 percent, soaring to US$ 108.52 million as compared to US$ 67.2 million in 2021.

The accomplishment proves India's potential as an investment destination and frugal engineering is acknowledged globally. The advanced technologies available these days for manufacturing cost-effective products is a pay-off to India coming a long way in establishing itself as an innovation hub.

> *"She had long ago learned an important lesson: there was always a way to wrestle with the impossible."*
>
> *- Suzanne Selfors*

It, thus, becomes highly crucial that we bring together our engineering marvels and showcase our progress proudly to the world. For which, IMTMA offers us the platform of IMTEX 2023 & Tooltech 2023 at Bangalore International Exhibition Center from January 19-25, 2023. The manufacturing technology show being held after a hiatus of four years is bound to be the cynosure for the entire manufacturing community. If you have not registered yet, we urge you to visit https://imtex2023-imtma.expoplatform.com/index/registration and do not miss being part of the mammoth event.

POWERED BY
Indian Machine Tool Manufacturers' Association

IMTEX 2023: SHAPING THE FUTURE OF MANUFACTURING

The manufacturing community is jubilant at the comeback of the much-awaited show on metal cutting and manufacturing IMTEX 2023. The trade fair, which has been helping business entities remain relevant in the changing times and stay ahead of the technology curve, will be in its bigger and better avatar, with Tooltech and Digital Manufacturing as its concurrent shows.

Source: Magic Wand Media

The 20th edition of South and South East Asia's largest exhibition on metal cutting and manufacturing technologies, IMTEX 2023, is around the corner. Coming back as an in-person exhibition after a gap of four years, IMTEX 2023 has Tooltech and Digital Manufacturing as concurrent shows at Bangalore International Exhibition Centre (BIEC), Bengaluru, from January 19-25, 2023.

The exhibition is timely as the Machine Tool industry is doing well in terms of production and consumption, with healthy order bookings in the coming quarters. IMTEX 2023 will play a significant role in connecting the various user sectors with the builders of machine tools, accessories, and solution providers.

Stakeholders from sectors such as Auto, Auto Components, Tool & Dies, Aerospace, Defence, Railways, Power, Medical Equipment, General Engineering, and more can network with original equipment manufacturers (OEMs), displaying the latest technologies, launching new products, and giving a glimpse of nascent developments. Visitors can interact with many players in one place to keep themselves abreast of trends, national and international, and take informed decisions. Exhibitors will get an opportunity to compare their products with those of their peers.

Exhibitors from across the world will showcase new products such as high-precision, high-performance, multi-tasking and special-purpose machines, robots, cobots, tools, accessories, manufacturing software, 3D printing solutions, evolving Industry 4.0 hardware, software, and solutions, and much more. OEMs, suppliers, manufacturers, sourcing agents, investors, and researchers, among others, will be at the show to connect with end users and offer products and solutions to various user sectors.

Source: IMTMA

IMTEX is crucial

The Machine Tool industry plays a pivotal role in the growth of the Capital Goods sector, which contributes to the economic growth of a country. IMTEX brings national and international companies on a unified platform for business-to-business deliberations and closer interaction between vendors and customers and facilitates networking among all stakeholders. The turnout of a large number of visitors to the show proves that IMTEX is an important show that one cannot miss, according to Ravi Raghavan, President, IMTMA.

As against other exhibitions organized by specialized event firms, IMTEX is organized by an industry association in a purpose-built venue. IMTMA holds this exhibition not only for the benefit of its member companies but for the entire manufacturing community in India, says Jibak Dasgupta, Director General & CEO, IMTMA and BIEC.

The exhibition is a confluence of minds that are visionary, focused, and innovative, which helps business entities remain relevant in the changing times and stay ahead of the technology curve. For many of the small and medium-scale enterprises, IMTEX is the best avenue to find prospective buyers as they may have limited funds for marketing, adds Dasgupta.

IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023–A Sneak Peek

- Held as an in-person event after a span of four years. The last exhibition was held in 2019.

Source: Magic Wand Media

- **850+ exhibitors** from **21 countries,** including India, are to exhibit
- Occupying around **77,000 sq mt** of exhibition space in 5 halls
- Group participation from **China, Germany, Korea, Spain, Taiwan, and USA**
- **International Seminar on Manufacturing Technologies** on January 18, 2023, one day prior to IMTEX 2023. The objective of this International Seminar is to present the latest technological developments in manufacturing and allied technologies that users can adopt in their production processes. The seminar will have concurrent sessions on Machining, Work Holding & Tooling, Additive Manufacturing, Enabling Technologies, Emerging Trends, and Automation.
- **i2 Academia Pavilion:** Fruitful collaboration between industry and academia, when put to good use, can nurture technology development, resulting in industries enhancing their capacities to manufacture high-tech products, bring product diversification, and help localize imports. At i2 Academia Pavilion, premier institutions, including IITs, will be presenting their R&D to industries. Close to **35 institutions** have applied, and the shortlisting of colleges that can participate is in progress.
- **International Buyer-Seller Meet:** To promote exports of machine tools and facilitate market linkages for machine tool exports from India to other countries, IMTMA is organizing an international buyer-seller meet during IMTEX 2023. The Buyer-Seller meet provides a platform for B2B meetings between international and national players to explore the different market needs and opportunities.
- **Jagruti** is a special initiative in which students will be given a guided tour of the entire IMTEX, including a visit to the IMTMA Technology Centre in BIEC. Students from select engineering institutions will be a part of the **15th JAGRUTI - IMTMA Youth Programme,** scheduled for January 21 & 22, 2023.

The best is on its way

Sentiments are highly optimistic in the post-pandemic period, and exhibitors are excited to leverage the buoyant ambiance at IMTEX 2023 to showcase their products and explain their services in person to potential buyers once again, which will positively impact their business. Certainly, more collaborations, investments, and trade are needed despite the prevailing geopolitical challenges. We are confident that IMTEX will provide a platform for industries to explore business avenues during the show.

As against other exhibitions organized by specialized event firms, IMTEX is organized by an industry association in a purpose-built venue. IMTMA holds this exhibition not only for the benefit of its member companies but for the entire manufacturing community in India.

Source: Magic Wand Media

COPING WITH MARKET DISRUPTIONS

When a plant is digitally transformed, it is better equipped to deal with market disruptions. Read on to know why.

KIM CUSTEAU
Executive Vice President
Portfolio
AVEVA

As manufacturers deal with several challenges along their value chain, digitally enabled plants can help manage the crisis and even scale up for the future.

While the sector was already disrupted before the COVID-19 outbreak, recent events have further exposed structural weaknesses. Supply chains have been interrupted and have had to be redesigned. A volatile demand landscape has hit production cycles and disrupted inventory allocation. Add in labor shortages, an uncertain global economic recovery, and increasing regulatory emphasis on sustainability, and manufacturers are faced with a seemingly endless concern about every aspect of their businesses.

In a McKinsey global survey, 94 percent of respondents said Industry 4.0 tools helped keep operations running throughout the recent disruption. The experience of joint AVEVA and Microsoft customers shows how digital transformation can sustain and scale operations going forward in order to create profitable and sustainable business outcomes.

Companies can address labor challenges by replacing repetitive tasks with more automation, both physical and digital. Real-time, cloud-based remote access to plants and factories can improve decision-making and enhance collaboration for greater efficiency. Artificial intelligence can bridge knowledge gaps while optimizing production and sustainability.

In short, when a plant is digitally transformed, it is better equipped to deal with market disruptions outside the facility's four walls, whether these are demand-related or supply-related.

Smart factory, sustainable results

In Batam, Indonesia, a Schneider Electric factory used digital solutions to leverage innovation across the value chain with quantifiable and sustainable results. The facility produces 11 lines of Schneider Electric products.

Although operations were functioning well enough with an existing Internet of Things-enabled solution, factory management identified several other challenges. Besides equipment downtime and siloed data, a lack of visibility on shopfloor activity resulted in a delayed response to issues on the line.

Schneider Electric executives felt the answer lay in digital transformation. Smart factory solutions helped boost collaboration and unify data across the plant to manage and predict equipment failures while optimizing performance and reducing downtime.

Industry 4.0 at work

To improve asset performance management, Schneider Electric installed a cloud-based solution focused on increasing plant asset utilization and operational performance by providing accurate information on potential equipment outages. Additionally, lean management software was deployed to streamline discrete manufacturing. Together, the solutions monitor assets to identify, diagnose, and prioritize impending equipment problems, continuously and in real time.

The digital manufacturing solutions helped streamline order flow and production execution, tracking the transformation of products from raw materials to finished goods while evaluating and analyzing yield, quality, and plant resource utilization.

Early business benefits in Batam included a safer and more efficient factory, optimized asset and process efficiency, and secure, reliable operations. Within a short time of the implementation, Maintenance 4.0 had helped the Batam Smart Factory reduce downtime by 44 percent over 12 months. Digital performance management tools led to 12 percent higher operational efficiency and 5 percent higher employee engagement. Quality 4.0 for defect reduction led to a 40 percent reduction in scrap costs for some critical machines, while an integrated supply chain increased suppliers' service rates by 70 percent. As a result of the entire program, on-time delivery improved by 40 percent.

Most important for the team was how Industry 4.0 capabilities connected the shopfloor to the top floor. Because performance is now tracked in real time, something that was impossible previously, business heads can quickly make responsive, data-driven decisions in line with immediate market pressures. Across the value chain, improved resiliency strengthens trust, and enhanced efficiency reduces the plant's carbon footprint.

Digital lessons shared globally

The Batam facility now offers global manufacturers a template for best-in-class digital manufacturing; it was recognized as a Fourth Industrial Revolution (4IR) Lighthouse by the World Economic Forum. Schneider Electric has since extended knowledge gains from Batam across its worldwide network.

Like Schneider Electric, other early digital adopters in the Manufacturing sector fared better during the pandemic. From smart factory initiatives to e-commerce transformation, digital initiatives can support resilience, maintain momentum, and enhance sustainability. With the right digital toolkit, manufacturers can build a sustainable and competitive future.

Source: Magic Wand Media

From smart factory initiatives to e-commerce transformation, digital initiatives can support resilience, maintain momentum, and enhance sustainability. With the right digital toolkit, manufacturers can build a sustainable and competitive future.

WORKING IN TANDEM

The 'additive versus subtractive' war is passé. Listed below are 10 ways that show how machining and metal additive manufacturing are interconnected and enhance each other's possibilities.

Source: Modern Machine Shop

Fig 1: Additive manufacturing brings lightweighting to large-diameter tools, such as this 3D printed tool for machining the stator bore of an electric car motor. A more advanced version of this tool is now in use in the production and manufacturing of electric vehicles.

PETER ZELINSKI
Editor-in-Chief
Modern Machine Shop

A donut-shaped machine tool component called the AKZ FDS adapter illustrates the increasingly intricate links between additive manufacturing (AM) and CNC machining.

The adapter is part of a high-end machining center from DMG MORI capable of not just cutting operations such as milling and drilling, but also grinding within the same machining cycle. The adapter's purpose is to redirect coolant to the engagement area of a full-size grinding wheel, which needs very different coolant flow placement and flow shape relative to the smaller-diameter milling and drilling tools used in the same spindle.

The adapter's internal coolant passages used to be made via machining. These passages were intersecting holes drilled at different angles and drilled precisely enough to connect inside the part to create the direction-changing course around the annular shape. The holes were then sealed off at the surface of the part. In all, 46 sealing points were involved. The result was assembly work for all this sealing, plus the risk of leaking if any of these seals should fail over time.

But now the adapter is made in a way that reduces assembly work and ensures tighter containment. Additive manufacturing, via laser powder bed fusion 3D printing (LPBF) in 316L stainless steel, allows the body of the adapter to be made in a single piece, with internal coolant channels all grown into the solid part. What used to be an assembly of 71 components now is an assembly of five, thanks to all the assembly consolidation into this 3D printed piece, and leaking out of the main body of the adapter is essentially impossible now. In addition, coolant flow is improved because 3D printing allows for contoured, optimized passages, not straight holes joining at corners. Plus, the new version of the part is lighter; lattice forms in regions of the component where solid material is not needed, realizing a weight reduction of about 50 percent.

So, is the AKZ FDS adapter a case of additive manufacturing triumphing over machining? It's not that simple. The adapter still gets machined. 3D printing delivers advantages related to internal passages and part weight, but it cannot deliver a completed part; critical tolerances for mating surfaces and fastening holes are still achieved through milling and drilling.

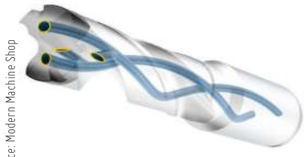
Is this part an example of how 3D printing makes what used to be a complex subassembly an easy part to produce? It is not even that, company engineers say, because realizing an efficient process based on additive manufacturing involved its own process engineering. In addition to providing for the downstream machining operations, another challenge was quickly removing loose metal powder from within the part's channels after 3D printing.

All of this is valuable to consider because of what it shows about the place additive manufacturing, particularly in metal, is finding relative to machining. In the case of the AKZ FDS adapter, additive manufacturing does all of this: It enables more capable machining by improving the design of a machining center; it replaces machining by realizing a part design superior to what machining alone was capable of producing; and it relies on machining, because 3D printing alone can't attain the necessary tolerances. All this is true at once. Meanwhile, additive manufacturing has achieved a solution that is simpler in some respects, while also entailing a sophisticated process.

Additive manufacturing has advanced quickly, and part of that advance has been to advance machining—not just in a case like the adapter, but also more broadly in cases such as cutting tools made through 3D printing.

Follows ten answers to the question: 'How do machining and additive manufacturing now interact with one another?'

1. AM Is Making Cutting Tools More Capable



Source: Modern Machine Shop

Fig 2: Additive manufacturing allows smaller tools to include effective through-tool channels for coolant delivery. Modular through-tool-coolant drills from Kennametal in sizes 10 mm diameter and smaller are made via laser powder bed fusion.

Source: Modern Machine Shop

Fig 3: The post on the as-printed form of this implant made through LPBF exists only to simplify machining. A chuck clamps on this feature, which is machined away once other machining operations are done.

Source: Modern Machine Shop

Fig 4: Machining capabilities needed for metal part production via laser powder bed fusion AM include wire EDM for separating parts from the build plate. The machine seen here from GF Machining Solutions is specifically designed for AM applications.

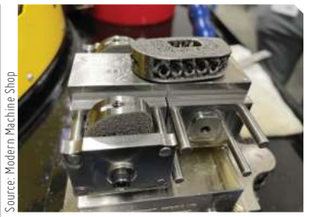
Additive manufacturing brings new possibilities to cutting tools for machining. Those possibilities apply to both big and small tools, as Fig 1 and Fig 2 of cutting tools illustrate. Both tools come from Kennametal. For a small tool, AM offers a way to get through-tool coolant channels into a narrow tool body. The company's KenTIP FS line of modular drills in sizes 10 mm in diameter and smaller are made additively through LPBF. Drills with such a small cross-section previously offered no practical way to machine precise internal passages into the body. With AM, the passages do not have to be machined; they are grown inside as part of the 3D printing, and they can follow a curving path that is conducive to efficient coolant flow.

Meanwhile, the large tool is for precisely machining stator bores for the motors of electric vehicles. In this case, additive manufacturing is important for realizing a sufficiently lightweight tool. The length and cutting diameter needed to machine the large stator bore result in a large tool. If this tool had been produced conventionally from solid steel pieces, it would have been too massive for use in the tool changers of established machining centers used in automotive production. But using 3D printed geometric forms to reduce the mass, com-

To an extent, machining is part of additive manufacturing, and machining knowledge is part of what is necessary to design and engineer the additive build effectively.

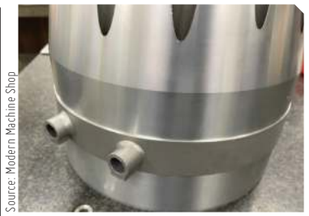
Source: Modern Machine Shop

Fig 5: Another capability needed for laser powder bed fusion: milling to resurface build plates.



Source: Modern Machine Shop

Fig 6: Final machining of production parts is an additional machining capability needed for metal additive manufacturing. This photo and the two preceding ones all were taken at RMS, a medical device manufacturer established in CNC machining that nevertheless decided to allocate special machining capacity to additive manufacturing.



Source: Modern Machine Shop

Fig 7: The area above and below the turning line around the OD of the part shows the precision of metal additive manufacturing. The turned section is obviously a truer circle, but the as-printed form is not far off. Because of this precision, machining for additive manufacturing entails light cuts. Part of the expertise of producing this microturbine housing involved forecasting just how much extra stock to add to the printed part for machining.

LPBF is arguably the most widely used and best established process for making metal production parts additively, and machining is used in at least three different, distinctive ways in support of this process.

bined with polymer composite in place of metal for the shaft of the tool, together delivered a weight savings of 40 to 50% compared to what a conventional tool at this size would have required, Kennametal says. Reducing tool weight is valuable even in cases where the tool changer is not a potential limiting factor. Less mass means less energy used to accelerate the tool up to full rotational speed during machining, and, therefore, less cost.

2. Design for AM Involves Design for Machining

Fig 3 shows another part developed by DMG MORI. The company makes both metalcutting machine tools and metal additive manufacturing systems (both laser powder bed fusion and directed energy deposition), placing its team members in good positions to explore tactics for using additive and machining in harmony. On this 3D-printed medical implant, a cylindrical post is added to the form that is 3D printed. This adds material and adds additive build time, but the payoff is much easier machining to complete the part. The part would otherwise be difficult to hold and locate, but the post provides a feature that the chuck of a turn-mill machine can readily hold for a rapid machining cycle within this machine tool type. The cylinder is then machined away as one of the final steps of that cycle.

The photo illustrates a significant point: Design for additive manufacturing is to a considerable extent design for machining. Production metal parts made additively can have organic, intricate forms that perhaps could not be realized in any other process, but those parts almost always will need machining to get to their final tolerances. An effective additive process needs to anticipate how the part will be held in the machine tool that will complete the part — so to an extent, machining is part of additive manufacturing, and machining knowledge is part of what is necessary to design and engineer the additive build effectively.

3. Laser Powder Bed Fusion Entails a Sequence of Machining Steps

Machining for metal additive manufacturing goes beyond just finishing the 3D-printed part. LPBF is arguably the most widely used and best established process for making metal production parts additively, and machining is used in at least three different, distinctive ways in support of this process. Fig 4, 5, and 6 illustrate this. Seen here is part separation from the build plate used in laser powder bed fusion by means of a wire EDM machine developed for this application; resurfacing of build plates for re-use via face milling of these plates on a vertical machining center; and the setup for finish machining a 3D printed components on a small machining center doing finer work. The point: A fully developed production metal 3D printing operation requires machining infrastructure in various forms.

4. Machining for AM Focuses on Light, High-Value Cuts

As additive manufacturing advances to take on more and more of part production, it will change the kinds of machining that is performed and the role that machining plays. Compared to other types of near-net-shape parts, additive parts need little machining, but the machining needed is particularly critical.

The part in Fig 7 illustrates this. The 3D-printed microturbine housing needs OD finish machining, but it is necessary to look closely to see the difference in precision between the original 3D-printed form and the machined section above it. That is, the additive form is not precisely round the way the CNC turned area is, but it is

Source: Modern Machine Shop

Fig 8: Manifold maker Aidro increasingly makes its components through additive manufacturing rather than by drilling intersecting holes into solid blocks. The company 3D prints manifold parts using both LPBF and binder jetting. (Aidro is part of AM technology provider Desktop Metal).

Source: Modern Machine Shop

Fig 9: Effective AM for production often will rely on workholding able to batch many parts for quick finish machining. Metal injection molders are already accomplished at this. This photo was taken at Smith Metal Products, a metal injection molder expanding into metal additive manufacturing via binder jetting.

Source: Modern Machine Shop

Fig 10: This is actually a picture of additive manufacturing. A simple milling step is vital to AM via laser powder bed fusion: returning build plates to precise flatness between builds. This milling step is part of the machining capabilities employed by 3D printed implant maker Tangible Solutions.

close. 3D printing delivers near-net-shape parts that are near to net shape indeed. Two implications of this are (1) the advance of additive for metal part production will call for greater use of machine tools emphasizing precise multi-axis motion but not necessarily heavy cutting, and (2) machining will increasingly focus on parts that have a significant value already built in before they come to the machining. A part like the one seen here is already nearly done, with hours or days of 3D printing to get to this point, plus heat treating. That means the stakes of the final machining operations and the importance of their being performed accurately become high indeed — much higher than they are with practically any other machined part.

5. AM Replaces Drilling for Internal Channels (Fig 8)

Some of the best candidates for production via metal AM are parts that require internal fluid flow. The previously mentioned adapter and small cutting tools are examples of this. Another is manifolds. Rather than drilling holes from the part's exterior so that they intersect to form manifold passages, AM offers the chance to 3D print parts with precisely the internal passages needed, and also with precisely the material needed to contain those passages (an optimized form rather than a block).

This is a potentially significant development as well in terms of the machining operations that will be important as additive manufacturing advances. Today, drilling is the most commonly performed machining operation. In a future in which additive manufacturing for production is more prevalent, that might still be true. However, drilling and other machine tool holemaking operations will be directed toward holes that need to be precisely straight and round. Holes that need to be passages, potentially with a curving path and without regard to the precise shape of the passage, will more often be 3D printed instead.

6. AM for Production Relies on Engineering of Workholding (Fig 9)

Another useful production application for metal additive manufacturing, not just powder bed fusion but also binder jetting, is many small odd-shaped parts produced at once in a single build. The 'oddness' tends to be a requirement, because very square or simple parts would be easier to machine than print. But if these organic-shaped or complex parts are small enough, easily dozens or hundreds of them could be 3D printed simultaneously in a single build. The challenge then becomes machining these parts, which means engineering workholding to allow for efficient setup in machining is a crucial ingredient of success.

One type of manufacturer that already has experience here is metal injection molders. Users of MIM produce odd-shaped metal parts in high volume that are then in need of machining, so they are already adept at custom workholding and tactics for high-density part setup on machining centers. Similar machining-related process engineering will come to be seen as an increasingly common aspect of metal additive manufacturing.

7. A Basic Milling Step Is the Beginning of Complex AM Parts (Fig 10)

This point emphasizes an operation mentioned in point 3 above, but it deserves further notice. It is not just that metal 3D printed parts are finished and brought to final tolerance via machining. It is also true that metal additive manufacturing in a sense begins with machining. Or at least, laser powder bed fusion metal AM begins this way, because the platform for this 3D printing opera-

Another useful production application for metal additive manufacturing, not just powder bed fusion but also binder jetting, is many small odd-shaped parts produced at once in a single build.

Source: Modern Machine Shop

Fig 11: On this large-scale polymer composite form made through additive manufacturing, machining accounts for more of the production time than 3D printing. The part is a nearly complete 3D printed housing for a flight simulator. Making this housing in just a few big 3D printed pieces contributed to an assembly consolidation that reduced the simulator's part count by thousands.

Source: Modern Machine Shop

Fig 12: Energy sector spare part maker Sparox 3D used low-cost metal AM via fused filament fabrication to manufacture these solar panel clips as an alternative to machining.

Source: Modern Machine Shop

Fig 13: Hybrid machine tools combine additive manufacturing with machining. This example was seen at the most recent International Manufacturing Technology Show. Phillips Corp. adds metal-deposition 3D printing heads to existing machining centers to convert them to hybrid machines.

With a hybrid machine, a broken or damaged feature can be machined away, 3D printed back in place, then machined to tolerance, delivering the component back into service through a means that is much faster while less expensive and producing a complete replacement.

tion is a machined component: the build plate.

Laser powder bed fusion is among the AM processes best suited to precise, complex, elaborately detailed components. But because the build generally needs a precisely flat surface on which to begin, the build plates used in this process are milled flat after every use. Complex additive manufacturing thus begins with—and counts on—a simple milling step.

8. Large-Format AM Multiplies Machining Needs (Fig 11)

The smaller an additive manufactured part is, the more precise it can be. As AM parts grow larger, rapid material deposition becomes a higher priority in order to keep the build time of the large part to an acceptable duration. As a result, though AM parts in general are near-net-shape, larger parts stray farther from net shape because material layer heights or layer thicknesses are large to speed the build. This means the amount of material removal needed to complete the part is a higher percentage of the part overall for larger 3D printed parts.

Another way of expressing this is: Machining time is a larger share of the process for larger additive parts. For polymer composite structures such as large tools built in room-sized large-format additive systems, the machining needed to complete the part can easily account for more time than the 3D printing.

9. Some Metal Parts Are Simpler to 3D Print (Fig 12)

This efficiency of machining for making a short run of precision components is hard to beat. The vast majority of parts made through machining today will still make sense to be made through machining in the future, even after additive manufacturing technology has further advanced.

But low-cost metal 3D printing options provide a cost-effective alternative to machining in a growing range of cases. For example, fused filament fabrication is the extrusion method of 3D printing usually employed for polymer, but the polymer filament can also be a carrier for metal powder, producing a green part that later becomes a solid metal part via sintering after the polymer is heated away. For short-run parts characterized by a bit of geometric complexity, 3D printing the metal part in this way can offer a simple and fast alternative to producing the parts on a CNC machine tool.

10. Machine Tools Are a Natural Platform for Metal Deposition (Fig 13)

So-called 'hybrid' machine tools incorporate metal 3D printing, generally via material deposition, into the same CNC machine that performs cutting. The same programmed motion that directs the cutting tool can also direct the nozzle and energy system for additive operations. Once while I was standing beside a long-time, experienced machinist who was overseeing a CNC machine tool performing metal additive manufacturing, he turned to me and said, "I never imagined I'd be ending my career putting the metal back on."

Bringing additive and machining this close together in the same machine, does not automatically result in a more efficient process, even when both operations are needed. If the time needed for 3D printing is long, then it is likely better to keep the machine tool available for machining. However, one application where hybrid machine tools are proving valuable is in the repair of existing high-value components, such as large tools or shafts. With a hybrid machine, a broken or damaged feature can be machined away, 3D printed back in place, then machined to tolerance, delivering the component back into service through a means that is much faster while less expensive and producing a complete replacement.

SHOWCASING MANUFACTURING MARVELS

Keeping up with its tradition, the upcoming edition of IMTEX will be featuring cutting-edge products and technologies for the manufacturing fraternity to have a closer look at them. Listed below are a few of the inexhaustible range of innovations that must be explored at the trade fair.

FIVE-AXIS MACHINING CENTERS

MAXIMUM PRECISION WITH THE MICRO5

For the last five years, the Micro5 has been leading a small revolution in the dynamic and highly precise world of machining tiny medical instruments, delicate jewelry and the most intricate watch parts. The FACTORY5 five-axis machining center from Chiron Group SE is extremely compact and can be set up very quickly almost anywhere – in the production hall or right at the workstation. The '5' in the name stands for the ideal 5:1 ratio of machine size to workpiece, for five times lower weight, and for maximum efficiency. Energy consumption is 50 times lower in comparison to conventional systems.

Knowing the company

The Chiron Group, headquartered in Tuttlingen, Germany is a global company specializing in CNC vertical milling and mill-turn machining centers, as well as turnkey and automation solutions. Comprehensive services, digital solutions and products for additive manufacturing complete the portfolio.

The Chiron Group is proprietor of the CHIRON, STAMA and FACTORY5 brands for new machines, as well as the automation brand GREIDENWEIS, CMS for refurbishment and HSTEC for motor spindles and fixtures. CHIRON machining centers are renowned for their highly dynamic design and their precision. The focus of STAMA is on stability and complete machining, while FACTORY5 expert area is high-speed machining of micro-technical components. GREIDENWEIS is a system partner for custom, end-to-end automation solutions, and CMS provides completely refurbished machines from the Group. HSTEC specializes in the development, manufacture and repair of high-speed motor spindles and fixtures. The final core area of expertise in the CHIRON Group is in additive manufacturing products and solutions.

Chiron Group SE
www.chiron-group.com
Hall & Stall: 4/C-113

S&T Machinery Pvt Ltd
www.stmcnc.com
Hall & Stall: 1A/A-117

VERTICAL MACHINING CENTERS

STM'S VL1600

The VL1600 is a VMC that offers rigidity, high performance, and quality output for large parts machining. With a combination of the wide casting base, supported with 4 guideways of equal sizes placed equidistantly, stability and rigidity are assured.

It has a spindle with a G1 balance grade that lowers distortion and vibration to achieve superior finished parts and better tool life.

A vertical column with a higher base contact and A-type structure strengthens the machine and minimizes the complete overhang for a higher travel of the Y-axis.

LM Roller Guideways with 3 nos shoes on X and Z axes is to overall enhance the heavy cutting and life of the machine. Directly coupled motors for all axes reduce backlash, belt/direct drive, chip conveyor, coolant through a spindle, auto tool changer and many more features make the machine versatile for machining precision parts.

Gedee Weiler Pvt Ltd
www.gdweiler.com
Hall & Stall: 1a/B-105

CNC TURNING CENTERS

UT 350 DUO WITH SUB SPINDLE

UT 350 Duo is a compact CNC Turning Center with a sub spindle that has its own linear axis and synchronous control that facilitates the 'on the fly' transfer of parts from the main spindle to the sub spindle.

A 12-station Servo Indexing Hydraulic locking turret with a twin-sided tool disc facilitates machining on the main spindle as well as the sub spindle, and also simultaneous machining on both spindles in certain cases.

UT 350 Duo compact CNC lathe with sub spindle enables I and II operations of the part to be completed in one setting with the 'on the fly' transfer, thus greatly reducing the throughput time and increasing productivity.

In addition, the In-Line accuracy or geometry of the parts produced in this machine is far better than doing the operations in two different machines as the component is unclamped from one machine and re-clamped again in another machine which leads to inaccuracies and also additional load/unload times.

Long and slender shaft components can be completely machined in one loading with intermittent component transfers from the main to the sub spindle in stages without the need for steady rest.

A pneumatic-operated part catcher is provided on the machine for the unloading of the components from sub spindle after the II operation.

When equipped with a bar feeder and parts catcher, the machine becomes a completely automated cell where a raw bar is loaded, and the parts get unloaded from the machine after I and II operations are completed.

A wide range of workholding options like 3 Jaw chuck, Collet attachment of different makes, and/or dedicated fixtures are offered to suit component needs. All necessary safety interlocks/provisions are incorporated to ensure a trouble-free and safe operation of the machine.

Lakshmi Machine Works Ltd
Hall & Stall: 5/107
www.lmwcnc.com

VERTICAL MACHINING CENTERS

J SERIES FROM LMW

LMW, Machine Tool Division is India's finest CNC machine manufacturing company. It will be exhibiting the new range of J Series Vertical Machining Centers at IMTEX 2023. The J Series machines have high demand in the market for its reliability, performance and precision. It provides a wide working area, spindle power ranging from 7.5 to 22 kW and spindle speed up to 12,000 rpm. The ergonomically designed machine supports easy loading and unloading operations. The tool change takes less than 2 seconds, saving significant time. The J series machines are highly versatile and cater to major industries like Automobile, Die & Mould, Pumps & Valves, Forging, General Engineering, etc.

Quality assurance is the core principle of the company since the year of its inception. It has incorporated the use of cutting-edge technologies for testing which ensures every machine shipped out of the factory conforms to stringent quality parameters.

LMW offers integrated solutions like tooling, CNC programming, CAD/CAM, IOT to meet the industry requirements. The products are designed in line with the company's commitment to deliver innovation and world-class excellence in all of its products and services to benefit the customers.

Jyoti CNC Automation Ltd
www.jyoti.co.in
Hall & Stall: 5/B-112

HIGH-SPEED DRILL TAP CENTERS

TACHYON FOR FAST DRILLING AND TAPPING OPERATIONS

Tachyon is a unique concept column moving fast machine suitable for fast drilling and tapping operations where the continuous production line requires precision component output in mass. Tachyon series machines are specially designed to suit the applications where the high dynamic machining solution is desired. The word 'tachyon' is derived from the Greek word 'tachys' which means swift. Theoretically, it means postulated particles that travel faster than light.

The concept of the base and column structure is designed in such a way that the entire moving axis mass remains on the column, which results in achieving very high dynamics while maintaining high machining accuracy. Due to this design, the Tachyon series machines are offered with a rapid traverse of 60 m/min in all three axes and the Z-axis can achieve a high acceleration of 15 m/sec^2 to suit the specific requirement of the automobile, surgical, and telecommunication sectors. The compact and stable design with Y-axis up to 400 mm allows greater machining envelop and sustains high cutting loads. The Tachyon series offers a higher Z-axis stroke of 450 mm, which is the highest among the global competitors. This has been achieved by placing the Automatic Tool Changer (ATC) outside the machine area, making a unique design among drill-tap centers. Direct-coupled BT-30 taper and 10,000 rpm spindle is a standard feature of the machine. It is available with high torque and high spindle speed (up to 24,000 rpm) options.

Electro-mechanical workpiece changer with a load capacity of 300 kg is another special feature of the machine to improve productivity that is designed to operate without a hydraulic or pneumatic system, making it a trouble-free workpiece indexer. The machine with a fixed table is also available as a variant.

To achieve faster tool changing, the ATC of the machines is designed with a special mechanism for tool de-clamping. A shorter tool change arm offers a faster tool changing time of just 1.3 sec. The ATC is available with 16-tool and 24-tool options.

TaeguTec India Pvt Ltd
www.taegutec.com/pages/hi/
Hall & Stall: 3A/B-111

GEAR MACHINING SOLUTIONS

GEARSKIVE FROM TAEGUTEC

As is the case with any company that's been around over a century, TaeguTec has been continuously bringing innovative standard products to the market with its technological prowess in indexable insert tools. Over the last decade, TaeguTec has extended its expertise into indexable gear machining solutions.

The company is in the forefront of providing solutions for advanced gear machining methods like gear skiving with its GEARSKIVE indexable insert and head changeable tools. The head changeable tool permits gear machining in the range of Module 0.4 to 2.5 on 5-axis machine. The indexable insert tool can be applied to larger modules of 2.5 to 8. The GEARSKIVE solution will be a game changer for the Automotive industry for small module internal/external gears in single set-up for mass production. Carbide technology not only aids high productivity but also enables hard skiving after heat treatment.

Other advents include indexable insert Hob (M >3.0) and Gasher (M >3.0) for pre-machining of gears for the Wind Turbine, Railway, Construction Machinery and Defense industry applications. The Indexable insert finish gasher for general industry gears with precision ground involute profile inserts offers both accuracy and high productivity for internal/external gears.

TaeguTec's indexable insert shaper (M 3.0 – 8) compliments machining of gears where HOB and Gasher overruns are not permitted. The high cutting parameters and coolant delivery close to the cutting zone helps to achieve accuracy close to finish form and at the same time reduce machining time by 50 percent.

Source: Ace Robotics Pvt Ltd

ACING IT ALL

Ace Robotics Pvt Ltd (ARPL), India's first industrial robotics company, is committed to helping MSMEs embrace automation and find solutions to labor shortages and increased labor costs. Here's knowing more about the company, its endeavor to help smaller companies, and the passion that fuels it...

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Robotics has always been a dream for any MSME component manufacturer. Even though a robotics and automation requirement is mandatory for a company to reach higher productivity and improve the OEE, the high cost of the robot, recurring maintenance costs, and mainly the concern about the support from the imported robot manufacturer after purchase have prevented business owners, especially MSMEs, from going for robotic automation in India.

Ace Robotics Pvt Ltd (ARPL) leveraged this challenge and turned it into an opportunity. "By 2019, we started working on providing MSMEs with an industrial robot that can be affordable, easy to use, and less space-consuming. ARPL focused on addressing all aspects—from the pricing of the robot to ensuring robust customer support to maintain 95 percent uptime," shares Abilash Chakravarthy, Managing Director, ARPL.

The journey, he says, has been very good. "For a robot manufacturing company, where all the supporting components like mechanics, software, and electronics are manufactured in-house, it's always difficult. But we have enjoyed overcoming the challenges we have faced along the way," he adds.

All machine tending robots currently accessible in India are MNC robots purchased and installed as a solution by Indian robotics system and automation integrators, which means that the cost of said solution is controlled by MNC robotics companies. "We are breaking that phenomenon and cartel by providing our very own Indian indigenously designed, developed, manufactured, and installed robotics solution for nearly half the price of competitors," shares Aashish Surana, CEO, ARPL.

"So, we are pleased to have international competition raising awareness about the robotics industry since we have such a large machine tool industry market that no single company can serve," he adds.

Helping MSMEs find solutions

"Today, the biggest nightmare for an MSME is daily labor problems," points out Chakravarthy. "Whether it is permanent enrollment of blue-collar employees or contract labor, there are issues such as frequent attrition, indiscipline, improper work ethics, uninformed leaves, mobile utilization during work, and other unethical practices leading to firefighting for the mid-management of a mid-sized company or business owner in an SME, such as retraining, machine damages, tool breakages, inter-labor issues, etc."

In addition, he claims that with the given working capital issue, the MSMEs' largest cash outflow after raw materials is salary or labor costs. "If a business owner can invest in a robot, he will be removing all the labor-related firefighting that happens daily with an ROI of less than 24 months," he believes. "This is a great advantage for an MSME owner to focus further on getting new business rather than on daily problems for executing the existing business."

On offering custom-made automation solutions to MSMEs in India, Surana explains, "Our robots have been specifically designed to meet the needs of Indian MSME pick and place jobs like machine tending operations of a CNC, VMC, gear hobbing, or any other machine operations that have mundane, repetitive pick and place jobs today being done by a human operator."

Citing that in the Indian Machine Tool industry, more than 30 percent of MSMEs do smaller parts that are less in size and weight, he elaborates, "For these purposes, if we install a bigger robot, it is a waste of space and money for the MSME owner. Instead, we have designed and structured the outer arm dimension to be the same as that of a human hand for lower space consumption and easy entry and exit of the machine, which can easily replace the salary expenses currently being spent by the business owner."

Indigenous product development

For decades now, India as a country has been dependent on MNC robots for any automation processes, which makes them a privileged commodity or solution for the large companies of the country, while the problem of a reliable, affordable solution has been ignored by all. "Breaking this," argues Chakravarthy, "our company Ace Robotics is India's first industrial robotics manufacturing company that has successfully done multiple indigenous designs, development, manufacturing, and implementation of machine-tended pick and place robot i+ for Indian MSME companies."

As Industry 4.0 becomes a basic need for any standard manufacturing facility around the world, he believes that automation, and robotics will be the go-to solutions for ensuring efficient, timely, and quality production in such a time- and price-sensitive industry. With global barriers higher than ever, he adds that imported solutions and repair work are becoming a major difficulty for all,

Source: Ace Robotics Pvt Ltd

"With the given working capital issue faced by the MSMEs, their major cash outflow after raw materials is salary or labor costs. If a business owner can invest in a robot, he will be removing all the labor-related firefighting jobs daily, with an ROI of less than 24 months. That is a great advantage for an MSME owner to focus further on getting new business rather than on daily problems for executing the existing business."

Abilash Chakravarthy
Managing Director
Ace Robotics Pvt Ltd

Source: Ace Robotics Pvt Ltd

"In India, currently, all machine-tending robots available are MNC robots that are bought and installed as a solution by Indian robotics system and automation integrators, which means that the cost of said solution is controlled by the MNC robotics companies. We are breaking that phenomenon and cartel by providing our very own Indian indigenously designed, developed, manufactured, and installed robotics solution for nearly half the price of competitors."

Aashish Surana
CEO
Ace Robotics Pvt Ltd

ARPL's robots have been specifically designed to meet the needs of Indian MSME pick-and-place jobs like machine tending operations on a CNC, VMC, gear hobbing, or any other machine operations that have mundane, repetitive jobs being done by a human operator.

Source: Ace Robotics Pvt Ltd

As Industry 4.0 becomes a basic need for any standard manufacturing facility around the world, automation and robotics will be the go-to solutions for ensuring efficient, timely, and quality production in such a time- and price-sensitive industry.

and the cost is an issue in the current working capital crisis for all MSME companies.

To make the robot suitable for the needs of the MSME, Chakravarthy reveals, "We have launched the i+ series family, which are 6-axis, 360-degree rotating robots with a 1,000-mm reach and a payload up to 3 kg, namely the i+Lite and i+Duo. While the i+Lite is designed for single robot, single machine tending operations for 24/365 days of product or batch manufacturing with recurrent schedules, the i+Duo is designed and built for dual machine tending tasks with a single robot, allowing for extended machining cycle times."

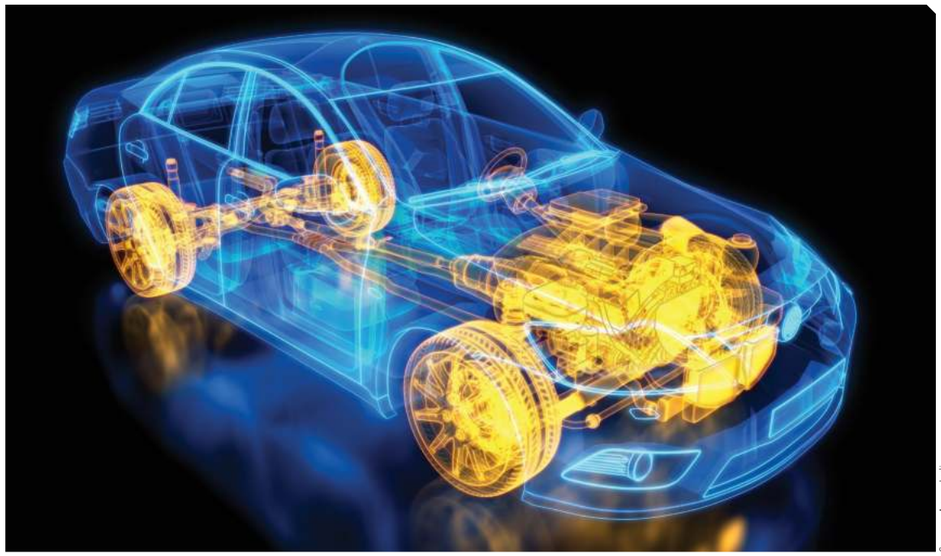
Challenges and plan of action

"As a technological company, difficulties and improvements have always been a part of our operations, and with our highly skilled engineers and technicians, we have always identified innovative solutions to overcome technical constraints," informs Chakravarthy. "In the course of development, we have come a long way from single-thread processing to multi-thread processing, adaptive error compensation at the firmware level, and a secured data packet format to prevent any software corruption."

He reveals his future plans, "Currently, we are operating in the 3 kg segment with dual models. We are working on newer models that support higher payloads and on 6 kg and 12 kg models, keeping in mind that the cost needs to be very low, and we have planned to launch these bots before the end of this year." He further mentions, "We have purchased an industrial plot and are progressing towards setting up a world-class bot manufacturing plant in Chennai with all possible reverse and forward engineering possibilities in-house to ensure we have absolute control on the products and solutions we offer to our clients at the best affordable price point."

SOLVING REAL-WORLD PROBLEMS SAFELY

An overview of how simulation can reduce time and cost in R&D, which otherwise is costly and time-consuming owing to the complexity of the vehicle system and design...



Source: Ansys India

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Across industries, designers and engineers are constantly undertaking hypothesis testing. They are on a never-ending expedition to find out what design will look right and fit the need of the hour. Testing and iterating are the essence of research and development. Major companies spend billions of dollars every year on their R&D efforts.

As per a study conducted by NITI Aayog and Institute for Competitiveness, India's spending on R&D is among the lowest in the world, and to achieve the goal of a US$5 trillion economy, the gross domestic expenditure on R&D (GERD) needs to advance. Although still low, India's GERD has tripled between 2008 and 2018, from ₹39,437.77 crore in 2007-08 to ₹1,13,825.03 crore in 2017-18. The growth is apparent, and GERD in the country has been consistently increasing over the years. All the governmental efforts towards 'Make in India' seem to be slowly bearing fruit.

India and R&D

Things are certainly looking up, and India even attracted US$343.64 million in foreign direct investment equity inflow into R&D in 2021, a jump of 516 percent YoY. According to NASSCOM, India's share in the global engineering and R&D market is projected to grow at a CAGR of 12-13 percent to reach US$63 billion by 2025, up from US$31 billion in 2019. India's current share of the GERD outsourcing market is 30 percent, and the country aspires to reach 50 percent within a decade.

Our Engineering R&D scene comprises Global Capability Centers (GCCs), Engineering Service Providers (ESPs), Startups, and India-based manufacturing companies. India-based GCCs and ESPs have extended their space to assume end-to-end ownership of global products. They are playing a vital role in planning the enterprise-wide digital transformation tactic. Furthermore, India-based GCCs and ESPs also support customized localization to unlock new market segments for global enterprises and build products that are 'Made for India' and for the world. At present, India is second among the countries with the largest increase in contributions made to high-quality scientific research. With its fast-paced innovation drive, India is poised to emerge as the most sought-after destination for scientific research.

Increase in R&D spending in the Automobile industry

Currently, the Automobile industry is undergoing its biggest

disruption, thanks to revolutions like electrification, connectivity, autonomous driving, and carbon neutrality. It has prompted an all-new battle among manufacturers who have no choice but to adapt to dodge obsolescence while they are competing in the market.

There are numerous factors that have driven the increase in R&D spending in the mobility industry. In the commercial vehicle space, more than half the R&D spend is happening either on emission compliance or hybrid and electrification (EV) trends. In the last few years, original equipment manufacturers have spent heavily on ensuring BS-VI compliance. Now, the bulk of the R&D investment is going toward EV technology.

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Simulation-driven product development

Typical V-Cycle of development for vehicles comprises Requirement & Specifications, System & Subsystem Design, Component Design & Optimization, Component Integration, and System Verification & Validation. Traditionally, engineering simulation was used for component design and optimization. With the recent advancements in simulation technologies, simulation can be used at all stages of the product development cycle.

For smart product development and testing, physics-based engineering simulation is a must. With this, there is no need to build an actual prototype. Engineers can predict what will happen and why it will happen with the help of physics-based modeling and simulation tools. This helps vehicle engineers make better decisions and make the 'first time right' design, thus saving both time and cost.

Next-generation simulation for future mobility

By 2030, EVs will secure approximately 32 percent of the total market share for new vehicle sales, and 45 percent of the vehicles sold will be highly automated, according to experts. In the future, EVs and autonomous vehicles will bring many advantages, such as lower emissions and traffic reduction. However, there are major barriers that must be overcome before we get there. Engineers must deliver more complex vehicles while limiting cost and maximizing safety and performance. Today's vehicles are highly multifaceted systems that must meet regularly evolving safety and regulatory standards set by regulatory bodies and governments.

Thus, we are also in the middle of the biggest technological transformation that history has ever seen, where there is the convergence of multiple technologies and megatrends revolutionizing the Automotive industry. How will we deliver this transformative mobility and transportation experience? There is an urgent need to innovate at an exponential rate to invent disruptive technologies and get them to market faster than ever before. Simulation tools offer a streamlined approach to designing and validating these vehicles in a fast and reliable way. It can allow the Automotive industry to achieve 1000x faster innovation while improving safety and performance.

To be competitive in the market, the future of mobility demands much more advanced levels of quality, reliability, and durability while being scalable and cost-effective. Engineering simulations help engineers in their innovation journey, reduce the cost factor, and solve multiple design issues in the shortest possible time.

Source: Ansys India

Detailed Vehicle Engineering using simulations

Better and safer vehicles can be built using simulation-led design in different aspects of the vehicle. Integrated multi-domain and multiphysics simulations can be used in multiple areas.

In Vehicle Chassis: From the suspension to the steering for Chassis Structural, Passenger Safety, Painting, Brakes, Suspension & Steering, and Wheels/Tires.

In Vehicle Powertrain: From the cylinder to the systems for the Internal Combustion Engines, Transmission, Fuel Systems, Exhaust Systems with Emissions Control, and Electric Powertrains.

In Vehicle Electricals: From antennas to ADAS for Wiring and Connectors, Infotainment, ADAS Systems, Sensors, and Antennas.

In Vehicle Exterior: From the cylinder to the system for External Aerodynamics, Aeroacoustics, Thermal Management, Water Management, and Soiling and Structural Integrity.

In Vehicle Interior: From the seat to the sound for Climate Control/HVAC, Cabin Acoustics, Crash and Safety, and Ergonomics/HMI/HUD.

For Electric Vehicles, simulation solutions allow rapid electric and hybrid vehicle innovation at both the component and system levels. Key applications comprise batteries and battery management systems, fuel cells, power electronics, electric motors, and the integrated electrified powertrain system.

Simulation capabilities are tailored to the detailed engineering needs of vehicle technology in Vehicle Engineering. These solutions aid the simulation of vehicle systems expansively with fully integrated structural, crash, fluids, thermal, electromagnetics, electronics, semiconductors, software, and system simulation tools.

Safety analysis and embedded software solutions are developed specifically to meet the requirements and standards of the automotive industry, such as ISO 26262 and AUTOSAR, to ensure Safety Engineering. This enables engineers to meet industry-required safety standards at a dramatically lower cost and at twice the speed of more manual or traditional approaches.

When it comes to ADAS and Autonomous Vehicles, backing up the safety by design and safety by validation approach, broad and deep capabilities are provided for simulating autonomous vehicles and advanced driver assistance systems. The software can be leveraged for high-fidelity, physics-based sensor modeling in ISO 26262 and AUTOSAR-compliant embedded software and human-machine interface development.

Source: Ansys India

Role of digital twins in Automotive Vehicle Design

Today, it is common for engineering teams to create a digital twin of a product or system to design, simulate, and verify its behavior and performance in the real world to find weaknesses, failure points, and limitations before manufacturing. This increases the quality, safety, and durability of the physical product. If we follow the analogy of taking 30 linear steps between each design cycle of the digital twin, we will only innovate in a linear manner and take much more time to optimize the product. We also run the danger of not testing and optimizing all the possible scenarios and boundary conditions.

For developing electric and autonomous vehicles, nearly 8 billion miles of road testing and safety engineering are required to ensure the delivery of safe, reliable, durable, and high-quality products at scale and a lower cost. So, linear innovation technologies and processes cannot deliver the future of transportation and mobility. Compounding improvements between each design and optimization cycle of the digital twin is critical. Leveraging the right digital transformation technologies and implementing the optimal processes on the digital twin of a product or system to achieve exponential innovation is critical to developing electric and autonomous vehicles.

To conclude

The latest and greatest automotive electronics providing enhanced safety, convenience, and entertainment is what is being sought today. Automakers will have to add these features without adding weight to vehicles, which means that there is a persistent push to make electronic components and packages smaller while increasing performance. What's more, all this must be solved in record time to remain competitive in the market. Simulation cuts the expensive test-fail-fix-repeat cycle, which fast-tracks product qualification while plummeting manufacturing risks. By integrating reliability physics/physics of failure (PoF) early in the product design and development cycle, simulation thus helps automakers bring new technologies to market faster.

Thus, simulation solutions are bringing next-generation innovation to vehicle design, as they can be used right from the concept stage of product development up to the testing and trial stage. Simulation helps in the reduction of prototypes during development as well as the development cost and time for manufacturers.

Simulation solutions are bringing next-gen innovation to vehicle design as they can be used right from the concept stage of product development up to the testing and trial stage. It helps reduce prototypes during development as well as the development cost and time.

TECHNOLOGY THAT APPEALS

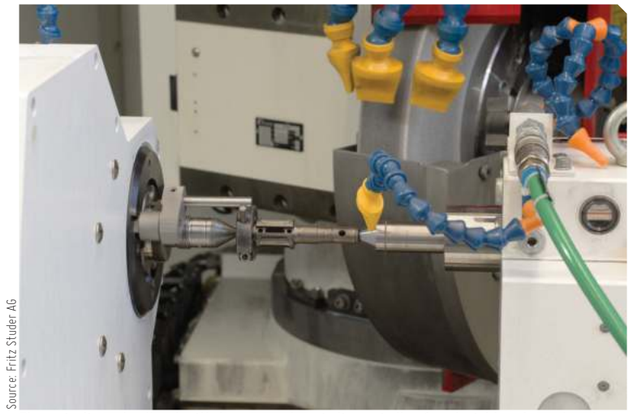
The S31 cylindrical grinding machine from Studer is proving to be truly universal at Apex Tool Group GmbH (ATG) in Westhausen, grinding gear and control shafts for electric and pneumatic Cleco assembly tools cost-effectively and flexibly.

Source: Fritz Studer AG

Electrical and pneumatic screw spindles, for example for the automated mounting of vehicle wheels, require the grinding of a large number of different 30 to 650 mm (1.18" to 25.6") long motor and gear shafts with diameters between 3 and 65 mm.

Source: Fritz Studer AG

The showroom of Apex Tool Group, formerly Cooper Power Tools, in Westhausen boasts an impressive range of different assembly tools from the Cleco brand, one of the six global ATG Power & Hand Tools brands. The tools include pneumatic and electric screwdrivers, either corded or with rechargeable batteries, in a straight, angled, and pistol design. In addition, there are complete assembly stations with an integrated control system that displays screwing assembly instructions on a screen, providing the necessary parameters for screwing and monitoring and documentation. The screwdrivers are used, for example, in the assembly of combustion and electric engines, car bodies, transmissions, and hydraulic units in vehicle manufacturing and in aviation, as well as for the automated mounting of wheels on vehicles. To meet current requirements for high process reliability and documented process-



Source: Fritz Studer AG

The swiveling wheelhead with two separate grinding spindles for straight and angular plunge grinding ensures short non-productive times and an extensive complete machining capability of motor and gear shafts.

es, the manufacturer equips the assembly tools with sensors for torque measurement as well as digital data transmission via cable or wireless (WLAN). As Niko Schindelarz, Supervisor Machining, explains, many manufacturers in the global industry consider Cleco assembly tools to be very high-quality, robust, durable, and reliable. A major contribution to this, says Schindelarz, is certainly the extensive vertical integration at Apex. The company produces almost all the essential screwdriver components in-house in Westhausen. This applies in particular to motor and gear shafts, levers, valves, cams, and housings.

Flexible for variants and individual features

"Due to a large number of variants and the increasing demand for individual features, we need to produce components in small series and even as individual pieces at very short notice," explains Johannes Mäule, Production Engineer in Westhausen. As he goes on to say, this applies to all production steps and processes, from turning, drilling, and milling through to grinding. "We need to grind our motor and gear shafts, in particular, to an accuracy of just a few µm. This is essential to ensure the extremely quiet running and long service life of our screwdrivers," adds Schindelarz. But this was still very complex until just a few months ago. Only one proven grinding machine, purchased back in the early 1980s, was available for cylindrical grinding. In order to grind the large number of 30 to 650 mm (1.18" to 25.6") long shafts with diameters between 3 and 65 mm (0.118" and 2.56"), it was necessary to laboriously reset the machine manually, over and over again. This was contrary to a needs-based and flexible production process. "Most of all, it was increasingly uneconomical. Set-up times generally took twice or three times as long as the machining times," explains Mäule. It was also difficult to achieve the required accuracies in diameters and cylindricity, especially with long, thin shafts, as Schindelarz remarks. As he says, this was only possible for experienced experts who had been grinding for many years. "These experts are currently retiring or will do so in the coming years. This means their know-how will no longer be available to us. However, the training of young talent is now focused on different aspects than it was just a few years ago. Manual interventions on machines are more undesirable, and the emphasis is on programming and optimal parameterization of processes," explains Schindelarz.

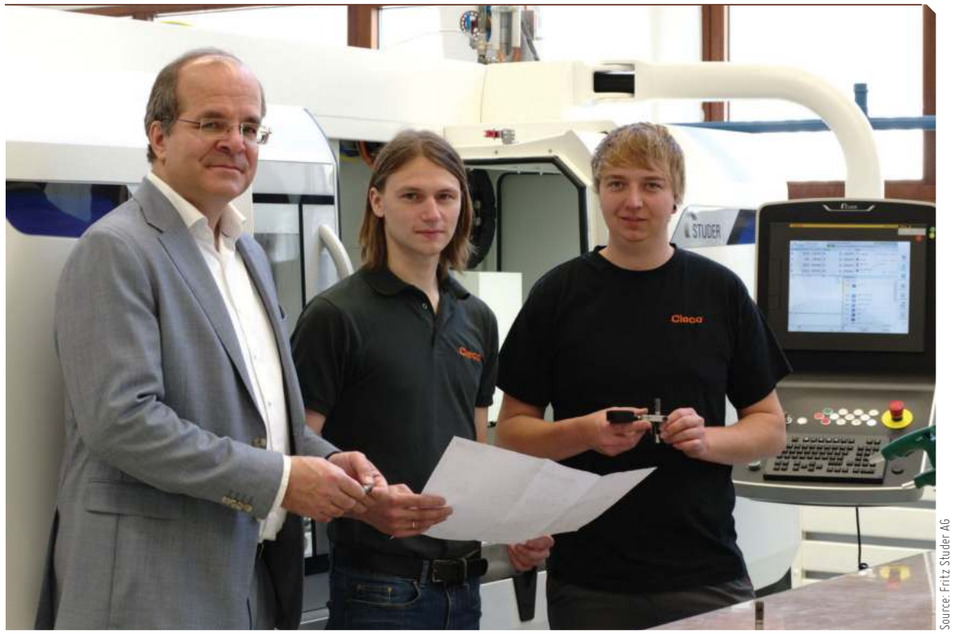
Generation transition

In this situation, the managers responsible at Apex decided to invest in new technology for

Source: Fritz Studer AG

The Studer S31 universal cylindrical grinding machine impressed the production engineers at Apex Tool Group with excellent working ergonomics, up-to-date programming, and user interface, as well as high flexibility, thanks to short set-up times.

The managers responsible at Apex decided to invest in new technology for grinding because the changing technical environment results in many additional demands on machines and production systems.



Source: Fritz Studer AG

Totally happy with their optimal investment in highly flexible, universal production technology with the S31 (L-R): Cornelius Wecht, Sales Head, South Germany, Fritz Studer AG; Niko Schindelarz, Supervisor Machining, Apex Tool Group; and a Programmer and Machine Operator, Apex Tool Group.

The production engineers in Westhausen are now able to grind the entire range of shafts on just one machine. The Studer S31 cylindrical grinding machine is easily accessible for workpiece and grinding wheel set-up, despite the complete enclosure.

grinding, as with other machining processes. This was because the changing technical environment results in many additional demands on machines and production systems. In addition to high flexibility, these include, for example, options for automated process monitoring and for transferring process and production data into a digital network—a smart factory. "Besides, we need the latest future-oriented technology in order to be an attractive employer and inspire much-needed new talent to come and work in our company," adds Schindelarz. After comprehensive comparisons of different machine concepts, he and Mäule decided to invest in a Studer S31 universal cylindrical grinding machine.

Highly flexible thanks to short set-up times

As Schindelarz explains, first of all, it was necessary to carefully prepare the requirement analysis to obtain approval for the necessary budget from the commercial manager in the US group. "However, we were able to clearly demonstrate on the basis of the operational benefits that the higher initial investment—in comparison to competitor products—will quickly prove profitable," agree Mäule and Schindelarz together. The production engineers in Westhausen are now able to grind the entire range of shafts on just one machine. The S31 cylindrical grinding machine is easily accessible for the workpiece and grinding wheel set-up, despite the complete enclosure. Agreeing with the machine operators, Schindelarz praises the excellent working ergonomics in particular. The production engineers in Westhausen benefit from much shorter set-up times in comparison to previous grinding machines. The special Quick-Set function only available on Studer grinding machines makes an essential contribution here. Cornelius Wecht, responsible for Studer sales in South Germany, reports: "Thanks to Quick-Set, the control stores the precise dimensions of all grinding wheels used on the grinding machine. This means you can also quickly set up frequently used and repeatedly dressed grinding wheels and use them again immediately. The control knows the precise dimensions after mounting the grinding wheel, and there is no requirement for re-measuring or even dressing the machine." The grinders in Westhausen consider the ability to dress profile grinding wheels directly on the cylindrical grinding machine as another advantage. The StuderDress software provides the corresponding cycles. With these cycles, only the required geometries are rotary dressed onto the grinding wheel profile. As Schindelarz confirms, this reduces set-up and non-productive times, on the one hand. On the other hand, it also ensures higher accuracies and better surfaces on the ground components.

Challenge

Apex Tool Group GmbH (ATG) in Westhausen needed to grind motor and gear shafts to an accuracy of just a few µm and ensure the extremely quiet running and long service life of its screwdrivers. The only cylindrical grinding machine available was the one purchased back in the early 1980s. However, that needed to be laboriously reset manually over and over again. Also, it was increasingly uneconomical. Set-up times generally took twice or three times as long as the machining times. It was also difficult to achieve the required accuracies in diameters and cylindricity, especially with long, thin shafts.

Solution

The company invested in the Studer S31 universal cylindrical grinding machine. The production engineers in Westhausen are now able to grind the entire range of shafts on just one machine. The machine is easily accessible for workpiece and grinding wheel set-up, despite the complete enclosure. It offers excellent working ergonomics in particular. The production engineers benefit from much shorter set-up times in comparison to previous grinding machines due to the special Quick-Set function only available on Studer grinding machines. The user interface is very easy to understand. Graphics and dialogs clearly guide operators and programmers through the input fields. The control also has a database with all the necessary grinding parameters.

Ideal for programming in the workshop

For Schindelarz, the control concept of the S31 cylindrical grinding machine also offers exceptional advantages. As he underlines, the user interface is very easy to understand. Graphics and dialogs clearly guide operators and programmers through the input fields. The control also has a database with all the necessary grinding parameters. "We call this StuderTechnology Integrated," explains Wecht. The machine operator selects the parameters which the software suggests based on the workpiece geometries as well as the required accuracies and surface quality. These ensure that the cylindrical grinding machine always reliably achieves a good grinding result. The experienced grinder can adapt the suggested parameters at any time in order to further optimize the grinding process. "The S31 is, therefore, ideal for use in the workshop. Any of our skilled workers trained in machining can also work flexibly on the cylindrical grinding machine. They do not require any specialized grinding knowledge. This gives us maximum flexibility," says Schindelarz.

Universal, thanks to B-axis

The S31 cylindrical grinding machine at Apex Tool Group in Westhausen has a wheelhead with a B-axis. The wheelhead can swivel in steps of 1°. It comes with two spindle drives, one equipped with a grinding wheel for straight plunging and the other for angular plunging. This also contributes to short set-up times and maximum flexibility. "We can plunge-grind a workpiece straight and at an angle in one cycle without any set-up work. This means we can completely machine almost all components in a single clamping," Schindelarz explains the advantages of the B-axis and stresses: "With the equipment we have chosen, the S31 cylindrical grinding machine fully deserves the attribute 'universal'. If there is one cylindrical grinding machine that deserves the name, then it's the Studer S31." After nearly five months, the S31 cylindrical grinding machine in Westhausen has proved that it completely fulfills the tool manufacturers' extensive requirements.

Exemplary consultation and service

Mäule cites another important aspect when making investments in production systems: "For a special technology like grinding, production engineers usually only have general expertise. This applies particularly to innovative equipment features on machines and their specific advantages in relation to individual requirements." As Schindelarz adds, researching current grinding technology was not so easy initially. "But the Studer specialists advised us in great depth and, above all, openly and honestly. We were able to develop our optimal cylindrical grinding machine configuration together in just a few steps," he continues. This built the necessary trust to confidently invest in the expensive S31 cylindrical grinding machine. "It was also important for us that service and technical advisers are regionally present and can advise and support us directly in production within a short period of time. This is essential to guaranteeing that our current and forward-looking investment in the S31 will prove profitable in the long run," emphasizes Schindelarz. As he concludes, Studer has completely fulfilled all relevant criteria with its specialists and the S31 universal cylindrical grinding machine.

The control concept of the S31 cylindrical grinding machine also offers exceptional advantages. The user interface is very easy to understand. Graphics and dialogs clearly guide operators and programmers through the input fields. The control also has a database with all the necessary grinding parameters.

INNOVATING FUTURE MOBILITY

The 10th edition of SAEINDIA International Mobility Conference (SIIMC 2022) convened the key players in the mobility ecosystem to showcase their innovations and share their expertise. A snapshot of the event...

Source: SAE India

With the aim to disseminate knowledge in the Mobility industry, SAEINDIA, in collaboration with SAE International, held its 10th SAEINDIA International Mobility Conference (SIIMC2022) as a phygital event on October 12-14, 2022, at the Hilton Bengaluru Embassy Manyata Business Park in Bengaluru, Karnataka.

The three-day event, themed 'Sustainable Multi-Modal Mobility Ecosystem', continues SAEINDIA's commitment to advancing and promoting mobility engineering.

Key highlights

More than 180 papers and 543 abstracts on engineering innovations were presented during the conference with the goal of encouraging sustainable and multi-modal mobility in India and around the world. TechHive, a specialized venue for technological presentations and product demos/B2B stalls, was the primary gathering area for mobility entrepreneurs and investors to chat and build business ties.

The inaugural session's Chief Guest was Dr Murugesh Nirani, Minister of Large and Medium Industries, Govt of Karnataka. Hon'ble Chief Minister Shri Basavaraj Bommai, Govt of Karnataka; Dr Ashwath Narayan, Minister of Skill Development, Entrepreneurship & Livelihood, Govt of Karnataka; and Randheer Singh, Director - Electric Mobility, NITI Aayog, also presented their views on mobility.

CV Raman, CTO, Maruti Suzuki; Vijay Nirani, Managing Director, MRN Group; Vinay Harne, CTO, TVS Motors; Brian McMurray, President, General Motors - Korea; Dr Sri Srinath, President, SAE International; and Prashant Doreswamy, President, Continental Automotive India, were among the distinguished industrialists who addressed the conference.

Other key dignitaries included Rashmi Urdhwareshe, President SAI, Co-Chair - Steering Committee and Former Director, ARAI; Mahesh Babu, Patron - SIIMC 2022 and CEO, Switch Mobility; Damodaran Subramanian, Member - Steering Committee, Former MD, Safran Engineering; and Munirathinam Dhananjayan, Chair - Organizing Committee Founder & MD, Focus Engineering.

EV adoption, the need of the hour

India's transportation sector accounts for 13 percent of total CO_2 emissions, and the demand is predicted to increase by 2.7 times over the next 30 years, boosting emissions. "While transportation has been critical to India's historical progress, it has been accompanied by various problems, the most significant of which is air pollution," says NITI Aayog's Director - Electric Mobility. "We need to decouple our economic growth from expansion in the motorized transportation sector."

Singh also noted that the average level of travel in India has climbed to 5,000 km per year, a threefold increase since 2000. "Vehicle ownership has also surged fivefold in the last two decades. On the freight side, it has resulted in a quadrupling in truck ownership between the years 2000 and 2019, or about 20 years. As a result, the move to EVs (Electric Vehicles) is unavoidable," he emphasized.

The National Programme on Advanced Chemistry Cell (NPACC) and PLI scheme seek to encourage companies to establish a Giga-scale of a minimum 5 GWh battery storage manufacturing in India over a five-year period. Currently, lithium-ion batteries dominate, but Singh disclosed that the development of alternative chemistries such as sodium-ion, lithium-carbon, solid-state, and flow batteries would ultimately begin and would be funded by the program as well. He also asserted that the onus is on the industry, and the EV needs to conform to higher safety standards as it impacts consumer sentiment.

Source: MMM

"We are working with more than 15 OEMs in India including Bajaj and others are underway and essentially variable to deploy on their scooters and vehicles or two wheelers and that's basically the synchronization into the cloud. So we manage the cloud, the cyber security layer, and the vehicle software integration, making it basically idiot-proof for the OEM."

(First from left): **Shivalik Prasad, Vice President Strategic Alliances and Sales, Sibros**

In terms of charging infrastructure, he sees four major breakthroughs:

- **Captive Charging Stations,** which will be directly driven by usage.
- **Public Charging Stations,** which will be the commercial EV charging stations.
- **Battery Swapping Stations,** where the battery is provided as a service, including everything behind the meter, mobility, stationary storage, and other storage-related things.
- **E-Bus Depot Charging,** where charging is done as a service, subscription models, along with bayside amenity services.

Combining efforts

PV Clean Mobility Technologies Pvt Ltd, a joint venture formed by Padmini VNA Mechatronics and Vitesco Technologies, showcased its key products at the event, including Fuel Delivery Modules, Air Intake Valves, Gasoline applications of Canister Purge Valves, Electric Coolant Water Pumps, and Coolant Flow Control Valves - Linear/Rotary. "All of these solutions that we are offering to the Indian market are already ethanol compatible," said Drone Tewatia, Manager, Marketing & Business Development, PV Clean Mobility Technologies. "The best part is that everything is already being manufactured in India. We are now exporting water pumps from India to Germany for various uses and starting to sell them to Indian OEMs for battery and motor cooling applications."

Shivalik Prasad, Vice President, Strategic Alliances and Sales, Sibros, a participant at

The conference featured over 180 presentations and 543 abstracts on engineering innovations aimed at boosting sustainable and multi-modal mobility in India and around the world.

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The key organizations that participated in the conference include Maruti Suzuki, Tata Motors, Volvo, Tata Consultancy Services, Ashok Leyland, Infosys, Bosch, Hindustan Aeronautics Ltd, Indian Oil Corporation, and the Indian Institute of Science.

Source: MVM

"Fuel Delivery Modules, Air Intake Valves, Gasoline applications of Canister Purge Valves, Electric Coolant Water Pumps, and Coolant Flow Control Valves - Linear/Rotary are being manufactured in India. We are now exporting water pumps from India to Germany for various uses and starting to sell them to Indian OEMs for battery and motor cooling applications.**"**

(Second from left:) **Drone Tewatia, Manager, Marketing & Business Development, PV Clean Mobility Technologies Pvt Ltd**

SIIMC2022 and speaker in the conference's panel session 'Going Autonomous & Connected - A Safe Road Ahead?' said, "We provide a software abstraction layer on any kind of vehicle, where we are able to collect data across any electronic control unit (ECU) inside the vehicle across any electrical architecture of a vehicle on demand up to a 1-millisecond frequency, and we have the ability to fully update every issue from the cloud into the car."

Stressing that EV adoption is a fundamental shift and a sustainable option, he revealed, "We are working with more than 15 OEMs in India including Bajaj and others are underway, and essentially variable to deploy on their scooters and vehicles or two wheelers and that's basically the synchronization into the cloud. So we manage the cloud, the cyber security layer, and the vehicle software integration, making it basically idiot-proof for the OEM."

Insightful discussions

Panel discussions were led by industry experts and researchers, featuring speakers from the country's leading automotive and technology organizations, as well as science and engineering institutes. The key organizations that participated in the conference include Maruti Suzuki, Tata Motors, Volvo, Tata Consultancy Services, Ashok Leyland, Infosys, Bosch, Hindustan Aeronautics Ltd, Indian Oil Corporation, and the Indian Institute of Science.

Some of the key sessions had the speakers discuss themes, including the role of the Automotive industry in meeting the challenges of global warming, the Design and development of low-cost electric microcars for urban commuting, Edge computing for multi-modal and inter-modal mobility, Building (Globally) connected car platforms – Unearthing complexity, Balancing of energy efficiency, Driving excitement and comfort in battery electric vehicles, and Is battery swapping a viable alternative to accelerate the electric vehicle adoption in India.

Source: MVM

PRESENTING MACHINE TOOL TRENDS

The 31st Japan International Machine Tool Fair (JIMTOF 2022), one of the world's largest machine tool exhibitions, organized by the Japan Machine Tool Builders' Association and Tokyo Big Sight Inc., held its in-person exhibition for the first time in four years, attracting stakeholders with renewed enthusiasm and exceeding expectations, from November 8-13, 2022, at Tokyo Big Sight.

Source: JMTBA

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World-renowned JIMTOF has a 50-year history of being held biennially. However, the unprecedented turn of events due to the advent of the pandemic disrupted its otherwise prompt schedule, leading to the postponement of the show by four years. On the return of the much-awaited machine tool trade fair that holds a record for setting a perfect stage for exhibitors and visitors to actively engage in business negotiations and information exchanges, Dr Yoshiharu Inaba, Chairman, Japan Machine Tool Builders' Association (JMTBA), stated, "JIMTOF, which was first held in 1962, celebrated its 60th anniversary this year. I am very relieved to be able to hold a face-to-face meeting for the first time in four years after overcoming the Corona wreck."

Echoing similar sentiments, Yasuo Tsukuni, Executive Vice President & CEO, Tokyo Big Sight Inc., added, "Since it is an onsite exhibition that's happening for the first time in four years, the overall expectations are quite high, which have already been exceeded. According to certain exhibitors, the business meetings were more fruitful than planned, implying a stronger Capex demand."


Source: JMTBA

"We would like to create value for the users of machine tools and provide them with encounters with new technologies that open the door (future) to optimal manufacturing."

Dr Yoshiharu Inaba
Chairman
Japan Machine Tool Builders' Association (JMTBA)


Source: JMTBA

"Since it is an onsite exhibition that's happening for the first time in four years, the overall expectations are quite high, which have been already exceeded. According to certain exhibitors, the business meetings were more fruitful than planned, implying a stronger Capex demand."

Yasuo Tsukuni
Executive Vice President & CEO
Tokyo Big Sight Inc.


Source: JMTBA

"This year's order volume is trending at a faster pace than expected due to brisk capital investment demand in Japan and overseas. Although future uncertainty is increasing, the manufacturing industry remains very busy, with solid demand in the medium to long term. As a result, we amended our prediction of ¥1.65 trillion for orders received at the start of the year to ¥1.75 trillion in September."

Kazuo Yuhara
President
Japan Machine Tool Builders' Association (JMTBA)

JIMTOF 2022 occupied the entire Tokyo Big Sight building with 1,086 exhibitors and 5,619 booths, making it the largest ever event, garnering 1,14,158 visitors, and including 4,686 overseas guests over the six-day event.

With the completion of the South Exhibition Hall in 2019, JIMTOF 2022 took up the entire Tokyo Big Sight building with 1,086 companies/exhibitors and 5,619 booths, making it the largest ever. During the six-day event, 1,14,158 visitors attended, including 4,686 overseas guests.

Driven by the right approach

In light of the theme of the exhibition, 'The Present and Future of Cutting-Edge Manufacturing: Machine Tools and Smart Factories', Dr Inaba asserted, "We would like to create value for the users of machine tools and provide them with encounters with new technologies that open the door (future) to optimal manufacturing."

The exhibition revolved around four key highlights:

Automation and labor-saving solutions: Many machine tool manufacturers displayed innovative products, technologies, and solutions concentrating on automation and labor-saving developed by linking machine tools, automatic measuring devices, collaborative robots, automatic guided vehicles, and so on.

Additive Manufacturing (AM): A dedicated 'Additive Manufacturing Area' was set up in the South Exhibiting Building, with an exhibition scale of 173 booths from 59 firms, making it one of the largest domestic AM shows, in addition to workshops held by exhibitors every day.

Response to the Sustainable Development Goals (SDGs): Set-up efficiency was targeted to be increased, and a showcase of Machine Tool industry efforts for the SDGs, such as enhancing the efficiency of equipment such as motors, was presented.

Disseminating Cutting-Edge Technology: The 19th International Machine Tool Engineers' Conference, IMEC 2022, was held in the International Conference Hall, with lectures and presentations on cutting-edge research in machine tools from Japan and throughout the world.

Four fascinating sessions were presented under the overall theme of 'Challenges for the Era of Great Change', including 'Trends in the Manufacturing industry toward Green Transformation' and 'Manufacturing Sites Changing with Digital Transformation'.

Japanese manufacturing and machine tool industry

Speaking about changes in macro indicators and future prospects, Kazuo Yuhara, President, Japan Machine Tool Builders' Association (JMTBA), stated, "Looking at the quarterly change in Japan's real GDP growth rate from the previous quarter, the most recent second quarter of FY2022 is up by 0.9 percent, and despite the impact

Source: MWM

of high resource prices, it is recovering moderately as the recovery from the Corona disaster and the removal of restrictions on movement progress." He also claimed that, while advanced countries are likely to decelerate across the board, Japan is expected to develop stably at +1.6 percent in 2023, according to the IMF's forecast.

Citing green shoots of recovery and the future outlook, Yuhara added, "This year's order volume is trending at a faster pace than expected due to brisk capital investment demand in Japan and overseas. Although future uncertainty is increasing due to rising inflation, interest rate hikes, and energy problems, especially in Europe and the US, the Manufacturing industry remains very busy, with solid demand in the medium to long term. As a result, we amended our prediction of ¥1.65 trillion for orders received at the start of the year to ¥1.75 trillion in September."

When compared to the same period last year, the total amount of Japan Machine tool orders received from January to September this year increased by 21.3 percent to ¥1,343.8 billion, the second highest in history.

Best of the best at the display

Showcasing Robotic Arm, LM Guide (Linear Motion Guide), and PPR Pick and Place Robot, Arun Sharma, Assistant Branch Manager - Delhi Branch, THK India Pvt Ltd, also provided an update on OMNIedge, a ready-to-use IoT solution developed for the Industrial Machine Tool segment, and stated, "It tells you about the health of your machine even from remote areas, so you don't have to place maintenance personnel nearby."

Urs Birri, Area Sales Manager Asia/Oceania, REGO-FIX AG, explained what powRgrip PGU 9500 is at JIMTOF 2022, "It is a highly accurate tool clamping system for very fast tool clamping. It provides high transmissible power and rigidity with a vibration-dampening system. It is a terrific technology that is being used in a variety of settings."

Presenting the Muratec MT200, Rishi Kapoor, AVP and General Manager, Meiban Engineering Technologies Pvt Ltd, said, "This machine is a multitasking machine and offers process integration. Turning and Turn Mill operations can be performed on the same machine. It is available with two/three turrets and two spindles. All of the turrets include the Y-axis to perform odd operations. This machine is designed for small- to medium-batch size components with quick changeover for automotive and non-automotive applications."

Jake Farragher, General Manager - Asia, ANCA CNC Machines, unveiled MX-7 Ultra and explained, "The MX-7 Ultra produces high-quality End Mills with a very fine finish. We have a new, unique control system that lets us regulate the machine down to the nanometer, which translates to exceptionally high-precision tools. It has an integrated laser for compensation, a six-wheel pack changer, and many other applications."

Source: MWM

Source: MWM

Shinji Yamamoto, Senior Manager Director, Fanuc, talked about its new large material handling robot, M-1000iA, at the event stall: "This machine has a wrist payload of 1,000 kg and features a serial link mechanism, allowing for a wider range of motion in both vertical and longitudinal directions and the arm to stand upright and rotate backward. This capability provides the users with extended versatility across a wide range of handling applications, allowing them to automate production lines and improve productivity in their applications."

Tomohiro Oshikiri, General Manager, Asia Sales, Makino Milling Machine Co., Ltd, on its latest a900Z Horizontal five-axis machine center at JIMTOF 2022, commented, "With an 800 mm part size, a 1,250 mm maximum walkthrough size, and payload weights up to 1,200 kg, this machine is a one-of-a-kind configuration of a five-axis machine with a tilt axis."

The European Association of Machine Tool Industries and related Manufacturing Technologies, CECIMO, also marked its presence at JIMTOF 2022. Filip Geerts, Director General, CECIMO, during a dialogue at the exhibition, pointed out, "The European Machine Tool industry experienced a significant uptick immediately following the COVID-19 breakout. In 2021 and 2022, we had a lot of production, and we still anticipate a 10 percent rise. But it is also due to a significant backlog, as there were numerous supply chain issues at the same time. As a result, I must say that our outlook for 2023 is more optimistic."

Offering novel solutions, Garven Hou, Industrial Partnerships/Key Account Manager APAC, Blaser Swisslube Asia Ltd, commented, "We have new products for Japan that need high-flash point regulations, and we also have some Neat Oils that resemble water but are actually based on modern technology. A Vasco 6000, which is excellent for hard steel and particularly for grinding applications, is one of our newer products. Additionally, we now offer the B-Cool MC 610, which may be used with a variety of materials, both when turning and milling."

Geared up for the next edition

The recent edition of JIMTOF set the tone for the much-anticipated post-pandemic industrial revolution and economic boost to Japan. With renewed vitality, the next edition in 2024, set to be held at Tokyo Big Sight from November 5-10, is much awaited by the industry and expected to outperform its 2018 edition, which drew a record 1,53,103 visitors, including 12,934 overseas guests.

JIMTOF 2018 drew a record 1,53,103 visitors, including 12,934 overseas visitors. The highly anticipated next edition is scheduled for November 5-10, 2024, at Tokyo Big Sight.

Source: MWM

ENHANCING COMPETITIVENESS

Indian Machine Tool Manufacturers' Association (IMTMA) organized the 16th edition of National Productivity Summit 2022, on November 18-19, 2022, at BIEC, Bangalore. The event showcased best practices in manufacturing through enriching keynotes, live case study presentations, and plant tours.

Source: Magic Wand Media

Manufacturing companies are constantly on the lookout for practices and processes that can help them reduce operational costs, upgrade the quality of their products, and increase productivity. IMTMA has made its mission to advocate for the cause of productivity in the Indian Manufacturing industry and provide it with a platform where the stakeholders can come together and learn from the companies that have deployed breakthrough practices that have resulted in significant improvements in productivity and competitiveness.

National Productivity Summit, organized annually, brings together industry experts, decision-makers, researchers, academia, customers, and suppliers of production equipment. The program highlights optimal manufacturing processes through informative keynotes, live case study presentations, and plant visits.

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Enriching experiences

The latest edition witnessed the participation of over 275 delegates from 95 companies across a diverse cross-section of the Manufacturing industry. The participants included CEOs, top management executives, senior executives, and practicing engineers from diverse industries such as Automotive, Auto Components, Die & Mould, Consumer Durables, Machine Tool, Tool Rooms, Aerospace, General Engineering, and other discrete Manufacturing industries.

Pre-summit plant visits were organized to Ashok Leyland, TVS Motor Company, SEG Automotive, Continental Automotive Components, Indo-MIM, and Tractor and Farm Equipment (TAFE), which provided a unique opportunity to witness some of the best productivity improvement projects being translated into action.

Addressing the audience during the inaugural session of the Summit, Ravi Raghavan, President, IMTMA, said that NPS brings out why companies should embrace integrated approaches to increase manufacturing productivity and how to prepare people, processes, and technology as part of the journey toward productivity excellence. He elaborated, "Many of our shopfloors are evolving at an exponential rate across the entire value chain, from machine tool manufacturers to organizations that employ machine tools and other manufacturing processes. In most manufacturing businesses that have accepted technology as a productivity enhancer, we are also seeing a lot of convergence between non-manufacturing and manufacturing processes, which is sort of a conversion between information technology (IT) systems and operational technology (OT)."

The event proved to be an excellent opportunity to hear from industry professionals on many aspects of boosting competitiveness in the Manufacturing industry. Dr Gopichand Katragadda, Founder & CEO, Myelin Foundry, was the Guest of Honor and delivered the inaugural keynote presentation on 'AI and Industrial IoT: The Last Mile'.

Appreciating IMTMA Mega Events' NPS 2022, he remarked that one of the event's key objectives is to learn from one another. One of the essential components is visiting factories and witnessing the operations in action. He added, "The chance to learn from the case studies of MNCs like Bosch to Indian companies like TVS is highly critical. The keynote presentations will take the discussions to a higher level of abstraction. You can take that abstraction down to your shopfloor and apply it to your specific needs."

Besides the inaugural keynote address, this edition featured two keynote presentations:

Dr S Devarajan, Senior Vice President, TVS Motor Company Ltd, spoke on 'Paradigm shifts in manufacturing and supply chain in lieu of technological Developments' and MS Shankar, President, Future Mobility (Innovation & Technology), Anand Group, spoke on 'Productivity - Innovating Sustainably'.

Dr Devarajan emphasized the need for sharing information and best practices, as well as visibility in terms of factory visitation and implementations, to keep manufacturing at the forefront. According to him, India needs to be more competitive. The country is completely capable of implementing best practices in manufacturing, which are supported by three areas. "First, the government is supporting PLI and logistics, which will come in a large way in a combination of all the multi-modal areas and is involved in the investment in machine tools and other industries, offering the appropriate time for technology adoption," he explained. "Second, India is a country with a large number of clients with extremely specialized requirements, and each order is unique, posing large product requirements due to volume. Finally, 'service', because customers increasingly choose it over products, which India can take up much faster."

Shankar said, "The revolution of Metallic 3D Printing in the sphere of vehicle manufacture has arrived. We have grown as a manufacturing economy as a result of a pool or team of machine manufacturers, manufacturing engineers, and large and small entrepreneurs." He added that 'a product or service is a function of opportunity' and emphasized that consumer needs are determined by a set of experiences rather than specifications. The sector must make a quantum

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Source: IMTMA

leap to megatrends and advances in digitalization, as well as the creation of a 'system'. He also made the audience ponder on questions such as: 'Are we competitive by eliminating waste in materials, resources, and efforts? Are we ahead of the competition?' before concluding his speech.

Source: IMTMA

Sharing ways to amp up productivity

Over 85 case studies were received for the Productivity Championship Awards 2022, of which 13 were shortlisted for the finals for their outstanding contribution to raising manufacturing productivity. Over the two days of the Summit, Bharat Electronics Ltd, Bangalore; Bosch, Bangalore; Hero MotorCorp, Haridwar; Hero MotorCorp, Alwar; Hitachi Astemo, Bangalore; Kasturi Foundry, Kolhapur; Kirloskar Oil Engines Ltd, Kolhapur; Larsen & Toubro, Kanchipuram; Mahindra & Mahindra, Kandivali; and Tata Motors, Pune, presented their case studies and offered an in-depth and multi-faceted understanding of the approaches they embraced to accomplish their business goals.

The summit also featured case study presentations from three SMEs: Associated Plasmatron, J.P.F. Metacast Pvt Ltd, and Mekhos Technology Services Pvt Ltd. The companies, in presenting their case studies, contested for IMTMA-ACE Micromatic Productivity Championship Awards 2022 with cash awards worth ₹10 Lakh.

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Case Studies in a nutshell

Bharat Electronics Ltd (BEL), Bangalore case study focused on how the defence major entered the field of manufacturing ICU ventilators for the first time and took up the challenge to manufacture 30,000 ICU ventilators in a record time of 90 days, against all unprecedented odds during the first wave of the COVID-19 pandemic.

Kirloskar Oil Engines Ltd, Kolhapur, team presented a case study on how the company enhanced its capacity and improved the productivity of existing machine lines through resource optimization. Theory of Constraints (ToC) was used to identify machining lines with lesser utilization and redesign the flow, eliminating multiple machines, mass balancing, and innovative fixturing to double-per-person output with reduced inventory and rejections.

Bosch, Bangalore, team explained how they met customer demands through the manufacturing of CBx (Common-Rail Beng) pumps aided by emerging technologies and digital solutions, resulting in substantial savings and a 30 percent productivity increase.

Larsen & Toubro, Kanchipuram, enhanced productivity through digital transformations in L&T's heavy engineering shop, eliminating paperwork in a project-based environment. The case study presented a digitalization approach that included the use of AI, VR, RFID, and IoT in the areas of fabrication and galvanizing.

Kasturi Foundry, Kolhapur, brought in productivity and quality improvement in Rear Axle Housing and Case for Front Axle (E68) machining line. It enhanced it in 2 value streams using robots in core painting and machining areas. This has enabled breakthrough benefits in cost, manpower, and electricity.

Hitachi Astemo, Bangalore team explained they improved productivity in a pressure regulator line through systematic and detailed process analysis, capacity study, loss identification, and measures, addressing bottleneck operations impacting PQCD (Productivity, Quality, Cost, Delivery) parameters.

Hero MotoCorp, Alwar, used TPM in a warehouse environment for enhancing productivity and reducing 'Mean Time To Preventive Maintenance (MTTPM). The company used customized IoT devices in a 'Conditional Based Monitoring' (CBM) network linked to warehouse management through 'Automatic Storage & Retrieval System' at its global parts center.

Hero MotoCorp, Haridwar, presented a case study modeled on the TPM, KK Pillar, using the traditional ECRS (Eliminate, Combine, Rearrange, and Simplify) method in its machine lines by setting a challenging target of 25 percent cycle time reduction using line balancing, casting improvement, and advanced tooling in a systematic way.

Mahindra & Mahindra, Kandivali, implemented the 'Single piece flow' concept at its legacy plant with space optimization and adopted an innovative approach in merging testing lines. The company, while manufacturing its Bolero vehicle, uses the time-tested concept of lean and rearranges the standard practices for productivity improvement.

Tata Motors, Pune, leveraged the market opportunity by scaling up the Nexon EV production. The evolution from a proto-shop to a mass production environment using conventional approaches has resulted in capturing huge market share and achieving breakthrough benefits.

J.P.F. Metacast, Belgavi, presented an insight into productivity enhancement through machining 28 families of parts involving the foundry and machining process in a short time span.

Mekhos Technology Services, Bangalore, explained how they enabled a global OEM to cut down complexity and costs, and set up change times in manufacturing cabin latch assembly of vehicles through the innovative design of fixtures, resulting in breakthrough productivity at the customer's facility.

Associated Plasmatron, Thane, enhanced productivity and reduced material consumption during HVOF (High Velocity Oxy-Fuel) coating of small parts with the help of a multi-spindle rotator system.


Source: IMTMA

Acknowledging talent

This edition's winners of the IMTMA-ACE Micromatic Productivity Championship Awards 2022 were chosen by the esteemed jury, which comprised Dr N Ravichandran, Chief Mentor, UCAL Fuel Systems Ltd; MC Ramakrishnan; and CV Subrahmanyam. The Guest of Honor for the Award Function was Tabrez Ahmed, General Manager, TKAP, who conferred awards to the winners at the Awards Presentation ceremony.

During an ongoing session, Ravichandran emphasized the following Cs: One must know one's Country, know their Customers and Competitors, be ready for Challenges, Change, take Charge, Conceptualize the change, most importantly Communicate, Carry out the change, Coordinate, and Control. All this will eventually lead to Cost reduction and Customer satisfaction.

Bharat Electronics Ltd bagged the first prize of ₹3,00,000 for their case study presentation on 'Manufacturing of 30,000 ICU Ventilators in 90 days'. Tata Motors, Pune, stood second for their case study presentation on 'Progressive increase of EV capacity through Productivity Improvement and Innovation' and won a cash prize of ₹2,00,000. The third prize of ₹1,00,000 went to Hero Motocor, Alwar, for their case study presentation on 'MTTPM reduction through Digitalization of PM activities in ASRS system by implementing IOT-based CBM monitoring system'.

Mekhos Technologies, Bangalore, was conferred with the SME Productivity Championship Award 2022 for their case study presentation on 'Productivity Improvement in Cabin Latch Unit Assembly & Testing Line'.

The Jury Commendation Award (Special Award) was given to Mahindra & Mahindra, Kandivali – Large & Medium Category, for their case study presentation on 'The Key to Boosting Efficiency – 'Single piece flow', a lean manufacturing method to improve efficiency by increasing productivity, reducing waste, and enhancing quality, and to Associated Plasmatron, Thane, for their case study presentation on 'To enhance productivity and reduce material consumption during HVOF (High Velocity Oxy-Fuel) coating of small parts with the help of a multi-spindle rotator system'.

Speaking of the summit, Prem Kumar, Senior Deputy General Manager, Bharat Electronics Ltd, said, "It is a very good platform for exchanging ideas, networking with people, and showcasing our capability. This kind of productivity summit is a must. The knowledge sessions make for terrific learning."

Sharing his experience at NPS 2022 as excellent, Rajeev Saxena, General Manager, Hero MotoCorp, Alwar, stated, "We went through various presentations and inputs given by Dr N Ravichandran, which was really great. Now we have a lot of ideas regarding the improvements that can be done on the shop floors. The main takeaway from this event is that we generally talk about the productivity of the operators. Now we are working towards the productivity of the staff, which will really enhance the value of our entire ecosystem."

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