Loading Upgrades

The latest advances in gear manufacturing automation all seem to revolve around a common theme: automated loading.

Alex Cannella, Associate Editor

Automation plays an ever-increasingly important role in gear manufacturing, and right now, the area of manufacturing that has people's attention is the loading process. A big part of automation's appeal is reducing manufacturing downtime, and one of the biggest parts of reducing downtime is minimizing setup time as much as possible, so perhaps it doesn't come as much of a surprise that this is still a primary focus for the field.

But even so, the incentives and challenges can differ from company to company. Klingelnberg, for example, has been following trends in the automotive industry, and they've seen that component demands are getting more varied. Gear manufacturers in the automotive industry are expected to be able to work with an ever-wider array of workpieces. That translates to more small lot production and a lot more setup time as Klingelnberg's customers constantly change up what they're making.

EMAG, for their part, has been continuing to expand their existing Trackmotion system, focusing on integrating more and more of their machines into the automated system. Instead of expanding the types of workpieces or the workholding, EMAG is expanding the list of gear manufacturing processes their equipment can automatically load a part for.

Gleason, meanwhile, has been working on the support side of the equation. They've been spending their time error-proofing the automated loading process with a number of smaller new technologies, improving part identification and integrating secondary operations into the automation process. Smaller backend advances like these may not be glamorous or eyecatching, but their usefulness in preventing potential production halts and eliminating user error can't be understated.

Automated loading is but one of many ways automation can reduce setup time and improve productivity, but it's being actively focused on by numerous manufacturers (Photo courtesy of Gleason).

All three of these companies are tackling different issues in the field of automation in completely different ways, so let's take a look at each one in a little more detail.

Widening Scope

The automotive industry is a-changin'. Electronic transmissions are growing in popularity, which means fewer gears per transmission, but also more demanding specifications and an increased emphasis on craft. Components are becoming more specialized, and as the people at Klingelnberg are starting to notice, more varied. And when manufacturers have to constantly stop and start their production lines to set up new runs of multiple different parts instead of churning out the same workpiece all day, we need to have solutions as flexible as the industry's demands.

Klingelnberg's most recent answer to the issue? Two flavors of conveyor-based automated part loading: a shuttle system for bevel gear machining, and a swivel loader for cylindrical gear grinding.

The first of these two solutions, the shuttle loading system, is designed for working with bevel gear cutters and grinding machines. This one was developed for use with the G 30 and C 30, machines built by Oerlikon, one of several companies that make up the Klingelnberg Group.

"The shuttle principle follows the idea of a pick-up solution but without compromising travel ways or speeds of the machine axis," Dr. Hartmuth Müller, head of technology and innovation at Klingelnberg, said.

The other solution, the swivel loader, is designed for cylindrical gear grinding and specifically installed in Klingelnberg's Speed Viper machines. It first uses a robotic arm to take a workpiece off the conveyor, then transfers the component to the machine's internal swivel loader, which then installs the piece on the work spindle. One machine, the Speed Viper^2 80, even has two indpendent work spindles, allowing the machine to grind one workpiece while loading the next.

Both of Klingelnberg's solutions are squarely targeted at small batch production. According to Müller, using their autoloading processes gives a technician

30–60 extra minutes to walk away and work on something else. And, as Müller noted, both solutions do so without any oil getting out of the machine and into the auto-loading system.

Joining the Family

On the opposite side of the spectrum, we've got EMAG continuing to expand their Trackmotion system. Trackmotion itself has been around for a few years now, so we can't really say the technology itself is breaking new ground, but bringing tried and true technology into new fields is just as useful.

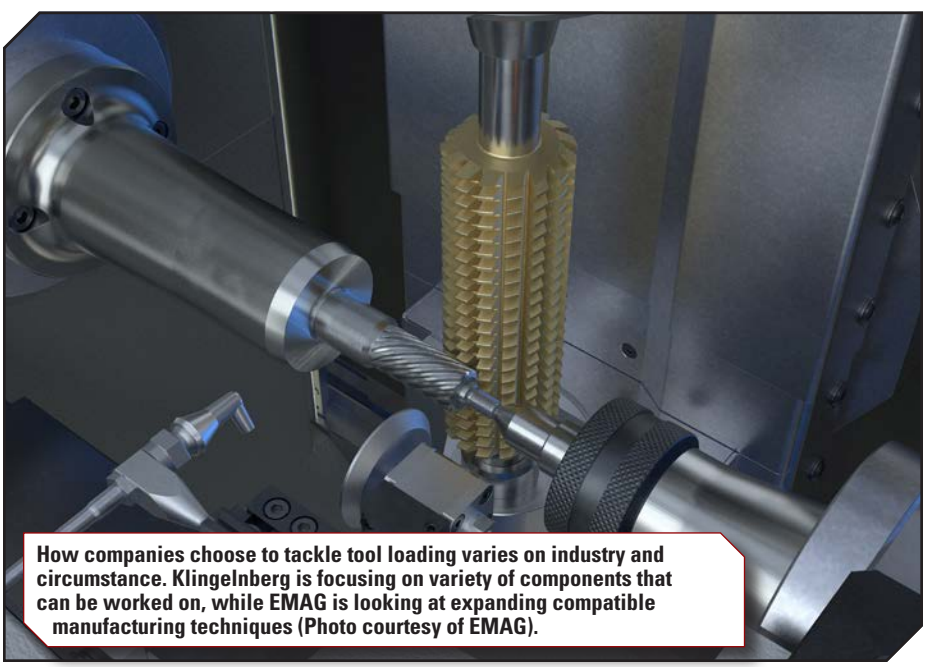
"EMAG has historically always provided our machines with the concept of being self-loading... This has always been part of EMAG's dna," Kirk Stewart, vice president of sales at EMAG, said.

Latest on EMAG's docket to add Trackmotion to is the HLC 150 H, a self-loading horizontal gear cutter that Stewart refers to as EMAG's "all-rounder." Much like with Klingelnberg's latest technology advances, the HLC 150 H is capable of tackling a wide range of components, handling dimensions up to 20" in length and 1–6" in diameter. It works with straight, angled, and worm gear profiles and performs hobbing, worm milling, skiving, chamfer cutting and deburring.

Beyond its wide-ranging applicability, there are two things notable about HLC 150 H. One is the Trackmotion system integration its gained. Trackmotion is EMAG's primary automation system, a low profile gantry set behind the cell that takes components from machine to machine, then auto-loads them. The idea is that if you have a full suite of EMAG machinery, you can set a Trackmotion system up to turn them all into one compact assembly line that automatically handles a part from start to finish.. And with the HLC 150 H's wide array of gear tooth cutting processes, that start-to-finish process chain can almost be done with just one supplier. This piece of the puzzle helps fulfill EMAG's mission of "providing the best manufacturing systems for precision metal components."

The HLC 150 H's other notable trait is its adoption of Fanuc controls. EMAG's usual in-house controller is more adapted specifically for gear hobbing, but in keeping with the machine's focus as an all-rounder, EMAG opted to utilize Fanuc controls that are used by a wider market. That's not to be mistaken as a shift towards making the HLC 150 H more of a multitasking machine, however — it's still firmly focused on gear manufacturing — but the broader market this machine targets is already more familiar and comfortable with Fanuc's controls.

"The conventional control...is rather specific to gear hobbing, which serves many customers very, very well," Stewart said. "But for larger users, there is some hesitation to use that niche solution. So ultimately, it's going after the much broader customer base which is already using, very comfortabl with, and very familiar with the Fanuc control."



How companies choose to tackle tool loading varies on industry and circumstance. Klingelnberg is focusing on variety of components that can be worked on, while EMAG is looking at expanding compatible manufacturing techniques (Photo courtesy of EMAG).

Error-Proof End of Arm Tooling

Eliminating errors is one way that companies can control costs and compete in the global market. Incorporating error elimination into products is one way that Gleason is meeting this challenge. Gleason has found that reliability is one of the strong selling points for automation and is incorporating error proofing into their machine tool tending automation.

When part identification is critical, Gleason uses a system that combines a camera and an illumination LED to verify that the correct part is being processed and that the part is oriented correctly. If the part is not oriented correctly an automated part flip process is employed to orient the part correctly. "This allows our customers to operate with complete confidence," said Christian Sterner, chief engineer at Gleason Automation Systems.

Sterner relates that, "Using smart grippers is another way we eliminate human error by verifying that the correct gripper fingers are installed before production begins."

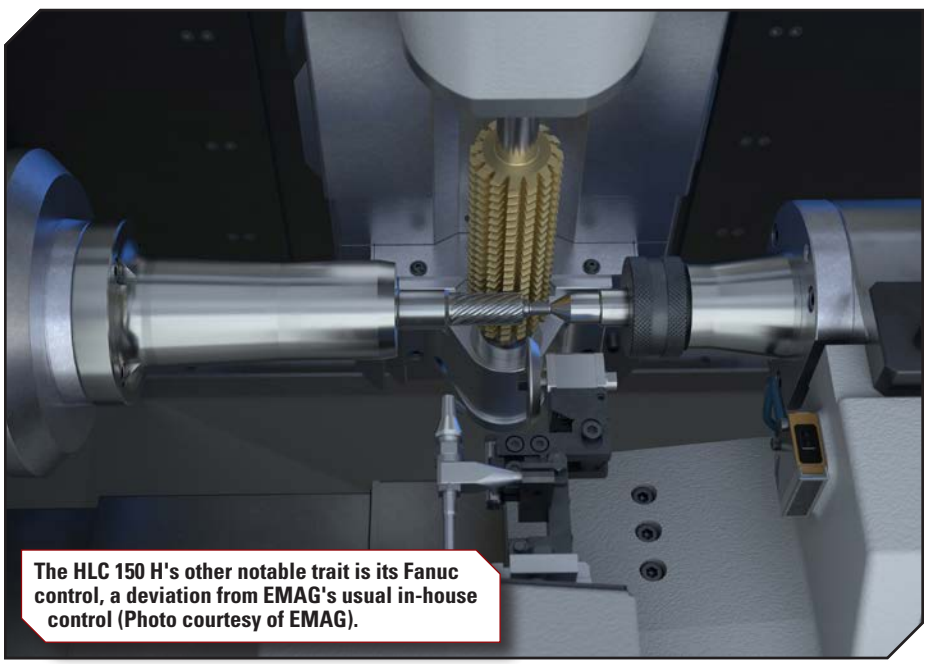
EMAG's HLC 150 H is the latest of a number of company machines capable of automated tool loading, expanding the possible manufacturing processes the family of machines can handle (Photo courtesy of EMAG).

This technology reduces costly halts in production due to mismatches between the part being processed and the gripper fingers that are being used. To reduce the time it takes to change the EOAT for a new part run and eliminate the potential for damage to tooling as well as ensure the certainty of repeated setups, Sterner recommends using Gleason's quick-change EOAT that automatically changes one complete EOAT for another. All mechanical, electrical and pneumatic connections are disconnected from one EOAT and then connected to another EOAT, in an automated process with the disconnected EOAT held in storage for future use.

"We have many proven solutions for our customers," Sterner said, "but when they present us with a unique set of requirements, we step up to the plate to create an innovative, cost-effective, solution."

One area that Gleason has focused on is the integration of secondary operations into the machine tool tending automation. Sterner emphasized, "We integrate test and verification solutions into the automation to ensure that all of the customer's parts are good and when necessary, we halt production before the process goes on uncontrolled."

Other secondary operations that Gleason has incorporated into the automation include rust prevention that is added to protect parts from corrosion and part marking which is used by some customers to identify critical information such as which cell manufactured a part for traceability when machining errors occur. "This value-added focus is what sets Gleason apart from our competition", said Sterner, "It's one of our strengths."



The HLC 150 H's other notable trait is its Fanuc control, a deviation from EMAG's usual in-house control (Photo courtesy of EMAG).

What Is It Good For?

The benefits of automated loading are the same as for other automated processes: improved setup time, reduced risk of user error, and the ability to walk away and just let the machine work for an extended period of time. Automated machines work faster and, for better or worse, don't ever deviate from their programming, making them also more consistent. It's just one of a hundred different ways that a manufacturer can reduce setup time and improve efficiency.

But people are always on the lookout for ways to do exactly that, and automation companies will always continue to expand what can be automated, be it an expansion of the components you can automatically produce, the methods you can use automation with, or the number of machine products you can apply automation to. And that trend shows no signs of ever slowing down.

For more information:

EMAG LLC
Phone: (248) 477-7440
www.emag.com

Gleason
Phone: (585) 473-1000
www.gleason.com

Klingelnberg America, Inc.
Phone: (734) 470-6278
www.klingelnberg.com

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