

The Road to Reliability

Gear Industry Steps Up to Automation Challenges in Auto Industry

Matthew Jaster, Senior Editor

Automotive parts are always moving. They are zipping across conveyors, smashing into each other in bins and traveling across the production chain before ending up inside an automobile. For gears, this can be a somewhat precarious situation as they tend to run best when they're free from nicks, abrasions, cracks or other damages.

While automation and process reliability is relevant to every aspect of manufacturing, the automotive industry gets special consideration due to the complex systems and production lines required. In short, they need to make gears faster, more efficiently and at the highest level of quality without errors or unnecessary downtime. This is where automation comes into play.

"If you're talking about a factory making 10,000 transmissions a day and there are 30+ gears in that transmission—that's a lot of components to work with," said David Goodfellow, president and CEO at Star SU. "The work needs to be done as quickly and efficiently as possible."

This means combining gear operations together such as hobbing/grinding, hobbing/shaving or hobbing/chamfering and deburring. The challenge becomes moving these parts across production cells, in and out of machine tools, changing workholding, cutting tools, etc. and somehow meeting rigorous deadlines in the process. In some situations, engineers must consider these concepts way back during the design phase of the machine tool.

"Everybody is trying to combine as many operations as possible," Goodfellow added. "Different applications have different requirements, however, so there isn't a single solution that will fit every customer. One of the key developments today is quick change tooling and quick change setups, both a critical part of high-speed automation."

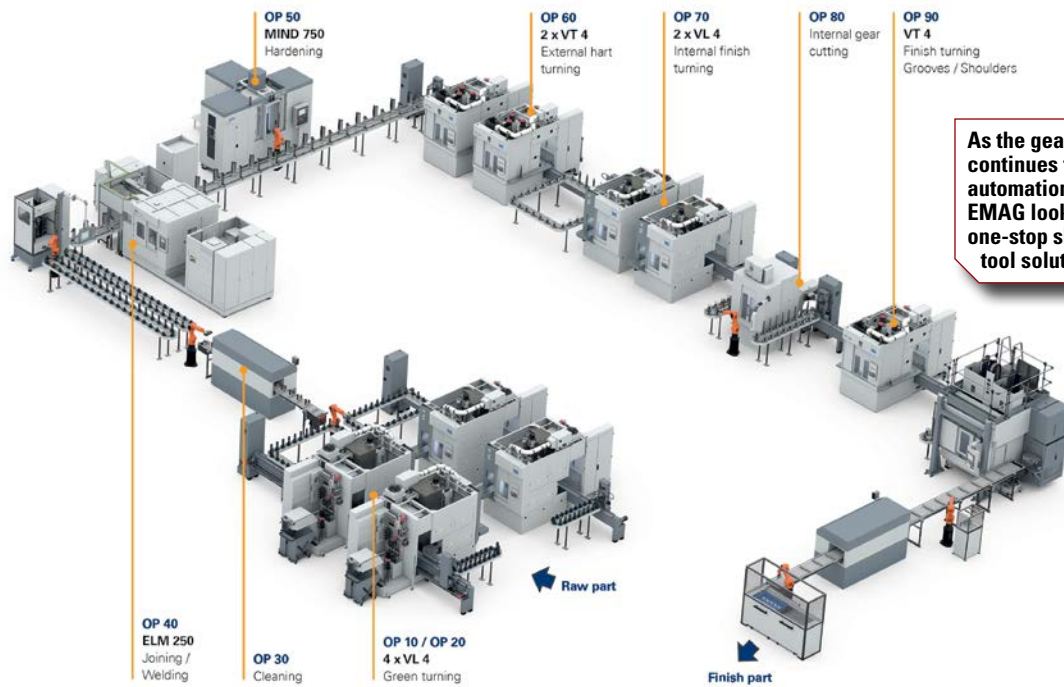
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As the gear industry continues to increase its automation capabilities, EMAG looks to provide a one-stop shop for machine tool solutions.

Gleason, Liebherr and Star SU offer automation technologies across several industries, but the following article will examine those used specifically in the automotive sector in 2018, particularly the benefits, challenges and future considerations.

The Need for Improved Setup Times

Time lost on an automotive factory floor doesn't bold well when it comes to production. Setup time is one area where quick changeover features will help keep everything moving faster and more efficiently.

One way to improve setup time in gear manufacturing is to remove it from other machining operations, according

to Matthew Skelton, vice president of sales at Felsomat USA, Inc.

"Since our solutions are decoupled from other machining operations, operators do not need to wait for any other equipment to be free before changing over. This strategy allows them to continue cutting chips on all other machines except the one which is being changed over which means more parts and profit for our end customers," Skelton said.

Felsomat's customers also demand that their new equipment purchases are able to rapidly changeover between part types without tools.

"Our automation solutions are providing our customers with an "on the fly" changeover which requires no operator involvement. This design allow operators

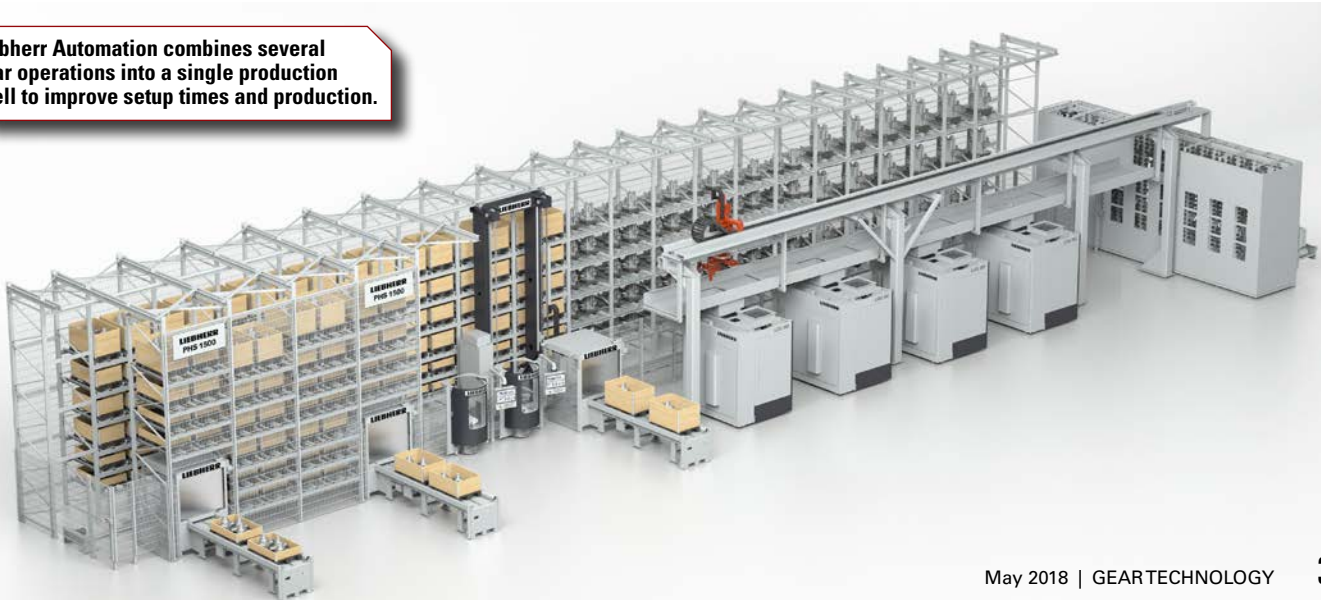
to concentrate on any gear production machine tooling changeovers that they may have while making the time between producing the last part to the next new part minimal," Skelton added.

Same goes for Star SU where quick changeovers are pivotal in automotive applications.

"An 8-speed transmission might be used in a passenger vehicle, a light truck or an SUV and they all have different gear ratios," Goodfellow said. "The part changeover requirements need to be completed without using wrenches, hammers, screwdrivers, etc. So we've developed machine tools that will hydraulically release the fixture at the push of a button."

Christian Sterner, chief engineer at

Liebherr Automation combines several gear operations into a single production cell to improve setup times and production.



Gleason Automation Systems believes setup times are improved by technologies such as quick-change gripper fingers, which eliminate the need to turn fasteners with a tool.

“There are further options that allow for quick setup as well – like automatically recalling previous settings by the touch of a button. The automatic purge function will purge the loader of any current part type without the need for manual intervention,” Sterner said. “The automatic tool changer also recalls previous tool data and forwards details to the machine tool for instant setup.”

In cells where part type changes are frequent, Dan Demlow, vice president, Liebherr Automation System, Co., said that Liebherr’s automation systems are capable of using a single reference point that would need to be verified after the tooling changes are complete.

“A simple part type change in the control module by the operator will then complete the setup portion of the automation cell in order to begin machining the new part type selected. Verification with the machine program will be automatic and create a message if the part types do not match between the machine and automation,” Demlow said.

External and Internal Automation Options

Automation systems can combine robotics with conveyors, basket stackers etc., but each system greatly depends on the specific needs of the customer.

Sterner said that automotive applications call for the integration of fast internal motions within the machine which allow for minimum chip-to-chip times in high-volume production. External automation can become favorable if simple external end-of-arm tooling can be applied so that only one hand is required to connect to the external handling requirements.

“The ability to tend more than one machine at a time with external automation is key because it is effectively decoupled from the machine tool operation, reducing external automation costs,” Sterner said.

With EMAG vertical pick-up machine technology the workholding chuck is

used to load the part. The system does not require gantry arms or robots to load and unload workpieces.

“This pick-up solution tied with our Trackmotion systems allows complete flexibility in gear production lines. Part marking systems, post-process inspection gauging, part buffers can be easily added to the system. For infeed –e step feeding systems can be integrated to work with our Trackmotion. Also traditional stacker tables can be used for those larger gears or blanks which are pre-turned. For outfeed we offer stacker tables or gears can be placed on outbound conveyors. If next operation is an external heat treatment EMAG also offers systems which can stack parts into racks,” said Jeff Moore, regional sales manager, Canada at EMAG.

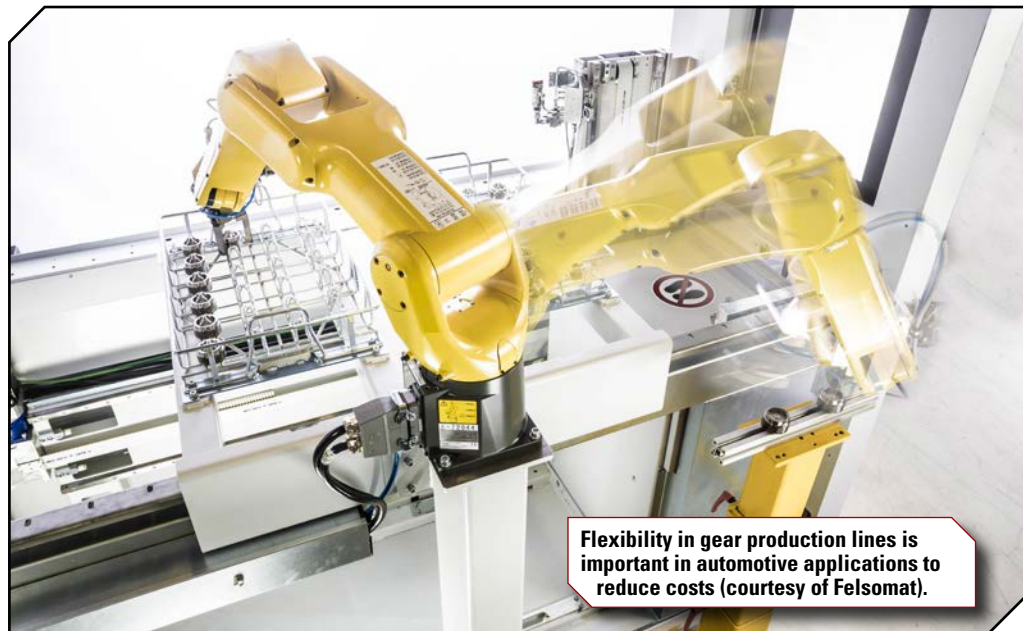
As processing cycle times for gear production continue to be reduced,

no concerns with coolant or oil escaping from the machine which allows us to offer the most compact solutions for our customer’s applications,” Skelton said.

“Usually cycle times are very critical with gear manufacturing. Any time you can decouple movements from the gear cutting process and concentrate machining activities within the machine and do peripheral activities outside of the machine (deburring, blow-off, gaging) using automation; it increases overall productivity,” added Demlow at Liebherr.

Goodfellow believes that both external and internal automation strategies are worth consideration.

“The automation system in an automotive plant needs to be robust enough to manage every aspect of gear production. We have to be able to connect to the machine, get the part in and out or



Felsomat aims to be as close as possible to the machine spindle with internal automation. “This close proximity allows us to reduce automation content and floor space requirements for our customers,” Skelton said.

Felsomat believes in this automation concept so deeply, it has developed a line of dry hobbing, turning, and welding machines with this principle in mind.

“Our two spindle machines have been designed with automation in mind. Since these processes are dry, there are

in a queue so that the machine is never sitting and waiting for a part. The structure of our SG 160 Skygrind best illustrates this where you have two spindles actuated by linear motors and a chip-to-chip time less than two seconds,” he said.

How Smart is the System?

As is the case with every other aspect of manufacturing, smarter automation or intelligent automation holds the key to gear manufacturing in the future.

“In 2018, we are making automation



Gleason is always looking for ways to improve its automation capabilities to reduce costs.

systems more efficient by closing the loop between them. For example, our machines can talk to metrology machines and streamline the connection between such systems. Data is transferred directly - simple and fast. This reduces errors and provides time savings which ultimately leads to productivity gains,” said Sterner.

In the future, Sterner sees automation systems having capabilities to diagnose and predict failures to reduce unplanned downtimes. This involves collecting, monitoring and analyzing the right data to be able to see patterns that indicate potential issues.

Moore at EMAG says that Industry 4.0 is all about networking – networking between several system components on one hand, and networking between machines and the people who direct the value chain on the other. “Focus areas include monitoring, analytics, evaluation, control, service and maintenance,” Moore added.

“Industry 4.0 initiatives have only begun to affect automation systems and manufacturing in general. In the future, all of this data that can and will be collected will allow manufacturers to better reduce downtime and inventory of spare parts as they are able to see failures arising faster as well as allow them to see the availability from their suppliers of the spare parts they need. Automation equipment will be fixed faster in the future as self-diagnosis in some cases will eliminate the need for a technician to come in and trouble shoot many automation downtime issues. The need for internet access security will also become

important as manufacturers must avoid the possibilities from remote contact to their equipment affecting machine uptime and efficiency,” said Skelton at Felsomat.

Wireless and remote capabilities are also on the rise, according to Demlow.

“Our systems are equipped with optional scheduling capabilities that allow the system to optimize spindle utilization of the manufacturing machines. Remote access is possible to reconfigure these schedules and provide immediate feedback to current conditions within the system (i.e. tool life, tool availability, cycle status, etc). Wireless capabilities may soon make it possible to do these functions with an app on your phone by authorized users if desired.”

Taking the Next Step in Automation

Each company is looking at ways to improve automation solutions in the coming years. Manufacturing can expect troubleshooting tools built into automation systems approaching AI-like capabilities, an increase in the use of collaborative robots and shrinking footprints by the elimination of guarding. Expect a significant increase in the use of AGVs (automated guided vehicles) to handle material flows on the shop floor.

“We see a clear trend to automated solutions to reduce cost and minimize error sources. At the same time, we see a cleaner and safer environment with more visual information at the fingertips of operators and supervisors. Information technology supported by 4.0 initiatives will support closed loop

manufacturing” Sterner said.

EMAG has seen the global auto industry pushing suppliers to decrease mass and reduce the overall size of driveline systems, specifically differentials. Lightweight construction in the automotive industry is a fight for every pound.

“More of today’s automobiles are offering an all-wheel drive or on demand four wheel drive system that require an added differential. CVT transmissions are becoming increasingly popular in the American and Asian markets. And with industrial megatrends including electromobility we’re positioned to meet the demands of our customers. Transmission manufacturing is among the most innovative areas of passenger vehicle production,” said Moore.

Demlow at Liebherr believes the current environment of the manufacturing sector could use more automation capabilities.

“Low unemployment leaves companies with unfulfilled opportunity because of the lack of personnel. Automation provides solutions that can be operated with minimal human interaction and can increase production during off shifts and weekends with “lights-out” capabilities,” Demlow said.

In the end, the technology will need to adapt to the trends of the automotive industry. No one knows for sure how that’s going to look down the road.

“Electric vehicles are coming. The gears will still need to be high-quality, but there will not be as many. This is going to be a big change for us in the gear industry,” Goodfellow said. “How these vehicles look 20 to 30 years from now will determine how our solutions might change in the future.”

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