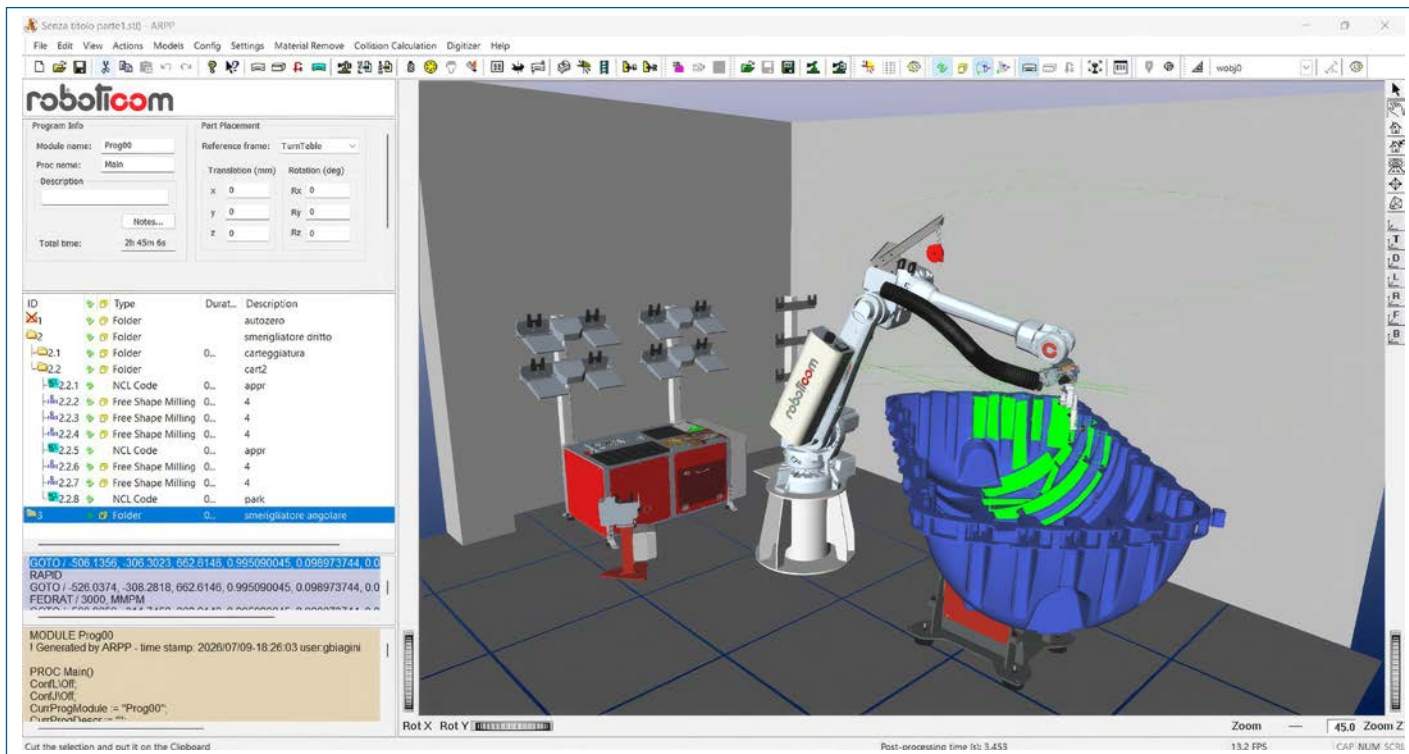


Robotic Polishing Automates Mold Finishing, Eyes Injection Molds Next

Robotic polishing automates finishing across rotomolding, composites and other mold types, with plastic injection molds a natural next candidate.



Offline programming and true 3D simulation enable users to design, simulate and optimize robotic movements before production begins. Source (all images): Forged Path Automation

Polishing molds by hand takes significant time, varies in quality and exposes workers to dust and hazards. New robotic systems using advanced software can automate these tasks, cutting processing times dramatically while delivering consistent results. Current real-world applications have concentrated on mold and forming processes such as rotomolding, thermoforming, sheet molding compound (SMC) compression molding, resin transfer molding (RTM), aircraft molds and stamping, and plastic injection molds are a natural candidate for the same automation. This approach can help shops maintain output, reduce reliance on hard-to-find skilled talent and improve workplace safety.

Simple Software-Driven Robotics

At the core of the system is user-friendly software that creates a digital twin of the part. “Operators can import virtually any major CAD file format, with .STEP files preferred for their ease of conversion and simulation accuracy,” explains Chris Urban, president of Forged Path Automation.

Users simply select areas of the model on screen and the software automatically generates the robot program prior to execution, eliminating the need for manual coding. During operation, operators can monitor the generated code in real time as the program runs.

It supports common industrial robots and includes force

sensors to control pressure, allowing adjustments for aggressive or gentle finishing. “If sensors detect excessive force during a run, the robot stops automatically and onboard alarms alert the operator, helping prevent damage from misaligned parts or unexpected surface conditions,” Urban says.

Robotic cells feature enclosures for dust control, custom linear axes for smooth, hand-like movements and various tool heads for different tasks. The system uses auto-zero probing to locate the part accurately, adapting to variation in part orientation without requiring precise fixturing — each application is evaluated individually to identify the best workholding approach.

“The system then trims edges and polishes surfaces automatically. This differs from older, rigid setups by focusing on adaptable processes rather than one-size-fits-all machines,” Urban says.

Programming is significantly faster than traditional robot programming environments too. “Operators typically program jobs roughly 10 times faster than with conventional tools and the software’s external-axis management, which is critical for polishing, is handled in ways that conventional robot software cannot match,” Urban says. It makes high-level automation accessible to operators without advanced training.

Scaling From Fine Detail to Large-Format Parts

This technology automates surface finishing, such as removing overspray or achieving a smooth polish. Examples include finishing complex composite parts in hours instead of days or treating coated components with fewer consumables. Cells can handle molds up to 6 meters by 3 meters (roughly 200 square feet) as a single setup. With a linear rail extension, width coverage can reach 12 meters or more, and very large molds can be processed in two sections by rotating 180 degrees.

It works on larger parts with multiple robots for extended reach. Also, for surface coverage, any area accessible with a 3-to-5-inch disc is a strong candidate; smaller features around parting lines or side walls can be addressed with unitized discs and flap wheels in the ¾- to 1-inch range.

“The highest-value approach typically has the robot system handle 70-85% of polishing, with an operator finishing the most complex or inaccessible areas separately,” says Urban. While the technology is expanding to other processes like cutting or coating, Urban says the main focus remains surface finishing, where

manual work is common. For moldmakers, it targets the repetitive polishing steps that vary by part geometry.

Speed and Safety

Processing times drop significantly. “Robot finishing typically takes one-third to one-quarter the time of manual polishing, translating to a 3-4x throughput increase, boosting capacity and allowing quicker turnaround. Results stay consistent and highly repeatable, removing variability from manual judgment, and measurements

provide clear quality data,” Urban says. For EDM scale and recast removal, the right media and programmed tool paths handle these surfaces effectively, provided the area is accessible.

Safety improves with enclosed systems that contain dust and reduce exposure to it. Labor shifts from hand work to simpler loading, unloading and oversight, helping to retain workers and ease skill gaps as experienced workers retire.

Consumable costs fall with optimized tool use. For example,



Quality is built into the process through tools that enable manufacturers to visualize, validate and control each step before and during production.



Flexible automation solutions can be tailored to industry-specific requirements for seamless integration and improved operational efficiency.

Mold builders dealing with labor constraints and efficiency needs should consider robotic polishing automation. It turns time-intensive manual tasks into reliable, faster operations with clear gains in quality, safety and capacity.

according to Urban, controlled, constant pressure extends abrasive life, resulting in 10-15% savings on abrasive costs compared to manual methods. Overall, it supports higher efficiency and scalability without large infrastructure changes.

Practical Considerations

“Setup may need testing for very intricate or tiny features,” Urban says. “As geometry increases in complexity, the value proposition decreases, since areas that cannot be reached with standard disc tooling require alternative approaches or remain manual.”

Surface finish is not predictable through digital simulation alone. Achieving a target Roughness average (Ra) value requires a series of trials on representative sample material

using various pressures, polishing media and other parameters before full production runs.

Upfront costs for full cells vary widely, from a basic setup to larger, custom configurations, depending on robot size, reach requirements and application complexity. Savings in time and materials often justify these investments through return-on-investment calculations, particularly given the 3-4x labor productivity gain and reduced abrasive consumption, according to Urban. For large parts, the system is generally designed as a stand-alone cell, though integration with other shop equipment can be considered for specific applications.

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FOR MORE INFORMATION

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