

3D ROBOT PROGRAMMING REDUCES COSTS AND STREAMLINES PRODUCTION

White Paper



SUMMARY

Robotic manufacturing processes, with their clear advantages of speed, cost reduction and accuracy, are being widely adapted for a broad range of production needs. But robot programmers frequently find it challenging to deliver material handling, arc welding, spot welding, or drill and riveting programs that work with certainty on the first run. Because robot programming is not part of the design phase, they are forced to implement fixes and workarounds on the shop floor. Costs escalate as production cycles expand and changes are made without knowledge of the shop floor impacts. However, DELMIA Robotics on the Dassault Systèmes **3DEXPERIENCE**® platform can deliver high-quality, collision-free programs in the native robot language with no need for intervention on the shop floor. In the virtual world, programmers and designers work in concert to create the most productive tooling operations and robot cycle times. Programming can move ahead independently without interrupting production, and robot programs perform predictably the first time. Costs of programming and production are significantly reduced, and products move to market more quickly.

THE CHALLENGES FACING ROBOTIC WORKCELL PROGRAMMERS

Increased Complexity

Some of the latest developments in robot technology make it extremely difficult for robot programmers, particularly when there are multiple robot arms. Programming collaborative robots is extremely challenging on the shop floor and increases the amount of risk to the product, tooling, and project schedule.

1. Spending time on the shop floor

Multiple variables can complicate robot programming, from changing part or tool designs to unreachable fastener placements and stringent cycle time requirements. Programmers cannot really be sure how a robot or tool will perform until the initial check on the shop floor. When design or programming changes are needed, validation can turn into a hands-on trial-and-error process while product designers and tool builders develop fixes. Time slips away, and project costs keep rising.

2. Lost production time

When robots are already in production, stopping to implement a change results in a loss of productivity. With no way to validate changes before taking the robots offline, every change made online is risky. Unexpected problems can lead to a lengthy production stoppage or even tool breakage.

3. Expensive shop floor damage

When workcells are validated on the shop floor, accidents can happen. Collisions are costly. Some of them happen because programmers lack first-hand knowledge of the physical process; they are working without being able to see the results.

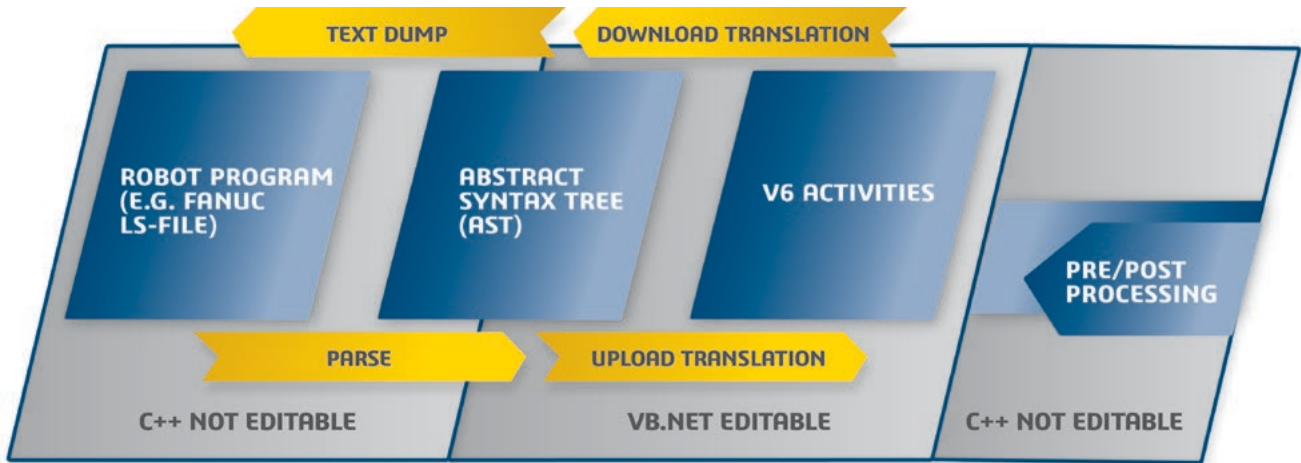
4. The need to fine-tune workcell performance

To optimize task assignments for multiple robots, programmers need to equalize the task load so no robot is underutilized. Balancing weld spots between robots, for example, can significantly reduce cycle times for manufacturers—but this is a time-consuming challenge for programmers.

WHY MANUFACTURERS ARE MOVING TO OFFLINE PROGRAMMING

Moving programming off the shop floor to a virtual environment immediately results in significant cost and productivity benefits:

- Programmers do not need to wait until the tools are built to create and validate programs; they work offline with precise 3D visualizations. Starting with product data and the resources—such as jigs or fixturing—that holds the part, they select robots, tooling and end-effectors to create workcells in the virtual world. They run simulations to validate the program.
- Production on the shop floor can move ahead uninterrupted while new programs are being authored and validated.
- Programs work safely and predictably the first time. Designs have already been validated. Programmers have a working knowledge of tool operation. Collision damage and delays are eliminated. There is no penalty for crashing a robot in the preproduction virtual world, where fixes are easier and quicker.
- Offline programmers are freed from the necessity of making shop floor fixes. They can use their time to make workcells operational within the project timeline, meet specified cycle times, and deliver consistent production quality.

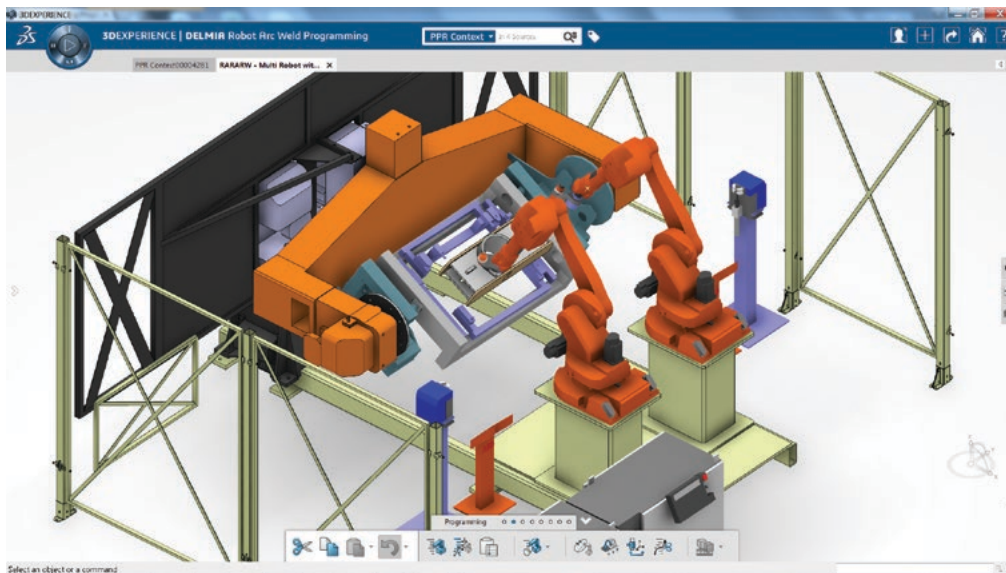


WORKCELL PROGRAMMING ON THE 3DEXPERIENCE PLATFORM

Many manufacturing companies have turned to DELMIA's trusted and widely used offline programming tools, saving validation and production time and maximizing productivity.

The **3DEXPERIENCE** platform unifies the user experience for all business processes. Built to answer customer and industry-specific needs for ease of use and lower training costs, its open architecture enables companies to customize enterprise data and integrate it into a single environment. It provides a single source of truth and a powerful process experience while helping to reduce the need for costly IT operations such as database replication. An intuitive interface provides easy-to-use navigation and search.

The **3DEXPERIENCE** platform enables real-time collaboration between design, manufacturing, and other disciplines to shorten product cycles and maintain high-quality production.



Reduce capital investment by designing and validating new robotic systems virtually.

DELMIA ROBOTICS TRANSFORMS THE PROCESS

DELMIA Robotic solutions for the creation of material handling, arc weld, spot weld or drill and rivet workcells integrate programming and visualization. Working from extensive libraries of robots and controllers, programmers position resources, program individual robots, debug robot motion trajectories, and orchestrate workcell sequences between robots and other resources. The **3DEXPERIENCE** platform lets them collaborate with design engineers and other stakeholders at all stages of process development, leveraging integrated lifecycle and change management capabilities. The process becomes more flexible and moves more quickly. Robot programs are sent to shop floor tools in the vendor-specific language.

Programmers use a context-based interface that simplifies engineering tasks and ensures that programs reflect the latest product design modifications. Multiple tools simplify tasks like gun selection, clash analysis, and trajectory optimization.

In terms of straightforward ROI calculation, the cost-saving benefits of DELMIA Robotics are multiple. They include:

- Better resource utilization
- Improved process validation
- Optimal workcell operation
- Validated robot cycle time
- Reduced capital investment
- Reduced shop floor fixes
- Better understanding of tool operation
- Production-ready robot programs
- Improved collaboration across disciplines
- Increased workcell throughput

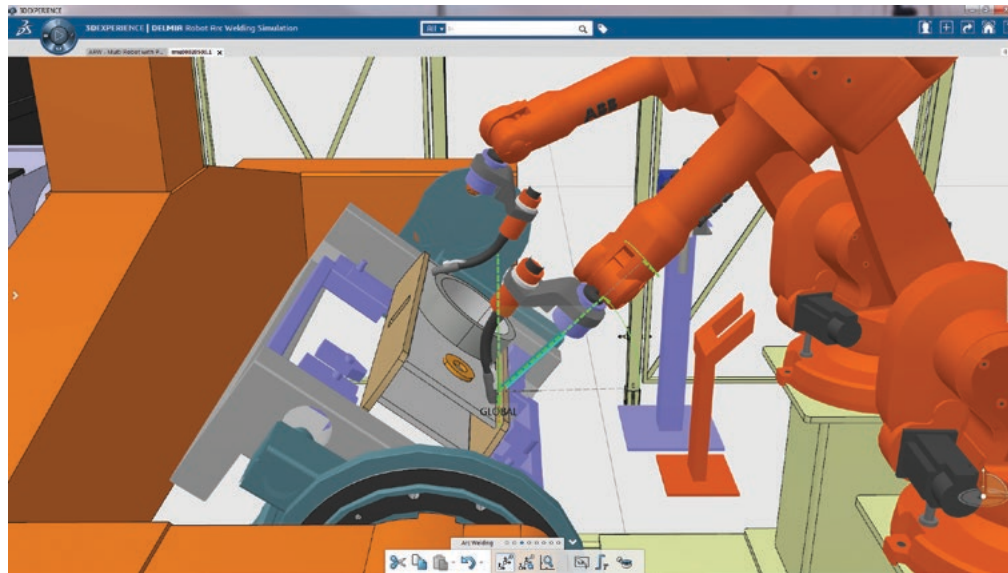


Advanced capabilities for robot path planning, weld gun selection, and analysis help programmers react quickly to new or changing product designs.

LESS PROGRAMMING. LESS COST. MORE PRODUCTION.

Reduced programming lead time

Robot programmers create, verify and validate programs in a virtual world that is separated from real-world production and download tasks in native robot languages. They spend less time on the shop floor implementing fixes and workarounds while production waits. Production keeps rolling and time-to-market shrinks.



Robot programmers create, program, simulate and validate an entire robot workcell before sending programs and setups to the shop floor.

The end of shop floor surprises

Because DELMIA Robotics provide comprehensive simulations of the workcell process, programmers can visualize tasks and ensure that robots move from source to target on collision-free trajectories. Design for Manufacturing (DFM) issues are identified early in the process, when fixes are simple and inexpensive and do not hold up production lines. Programs perform predictably the first time. Robot utilization is maximized.

Faster collaborative handling of design changes

As an example, workcell simulation may show that none of the guns can reach a specific fastener location. Programmers can easily and accurately communicate such issues to design or planning teams so the problem can be corrected before the start of production.

A single source of product and process data

The 3DEXPERIENCE platform lets companies store and manage product and process data in the same environment. Manufacturers can capture and store production programs for modification and reuse, saving huge amounts of programming time, increasing their agility, and moving products to market faster. They can also build corporate IP and standardize on best practices.

Load balancing and reduced cycle times

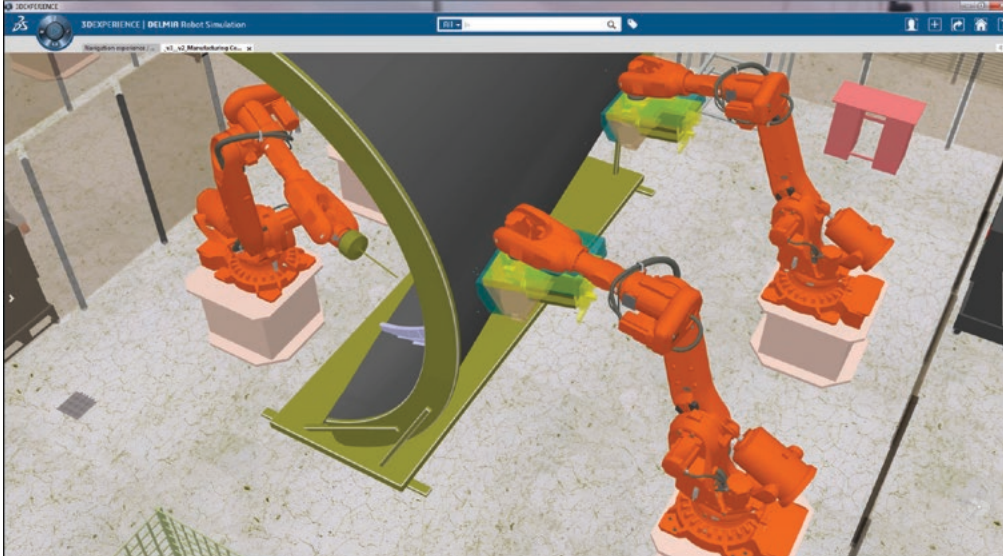
Programmers can simulate robots singly or in parallel to analyze reachability and task assignments. The workload can be equalized among robots to meet cycle time requirements.

Early studies and workcell configuration

DELMIA Robotics enables companies and integrators to conduct early DFM studies, eliminating upstream and downstream bottlenecks. Robots can be raised or moved in the virtual world to ensure that all fastener locations are reachable. Vendor proposals for new production cells can be visualized for evaluation.

Drilling and riveting simulation

DELMIA Robotics applications enable programmers to simulate both spot welding and drilling and riveting operations, making robotics a practical reality for the aerospace and automotive body-in-white industries. Robot paths can be automatically updated when designers change fastener locations. Off-the-shelf production robots can be programmed to execute the drilling and riveting process, eliminating the need for high-cost, purpose-built tooling.



Robot and NC programmers program, simulate, and validate complex automated drilling and riveting processes.

Faster response to requests for quotation

Cross-discipline collaboration on the **3DEXPERIENCE** platform enables the concurrent validation of tooling and process plans—which means that companies can respond faster and more accurately to RFQs.

TIMESAVING, COLLISION-FREE PRODUCTIVITY

DELMIA Robotics offers a clear path to more productive workcells and product lines. Separating programming from production, and delivering collision-free, first-time-right programs to the shop floor, keeps production lines rolling and moves products to market faster. Programmers leverage the **3DEXPERIENCE** platform and a host of productivity tools to program high-quality workcells more quickly. Real-time visual collaboration with design and manufacturing engineers simplifies change management and keeps process planning on track. The ability to modify and reuse successful programs saves massive amounts of programming time. DELMIA Robotics offers benefits that can make manufacturers more productive and profitable.

Our **3DEXPERIENCE**® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE**® Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced, and supported. Dassault Systèmes' collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 190,000 customers of all sizes in all industries in more than 140 countries. For more information, visit www.3ds.com.



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