# Robcad

## Digital manufacturing environment for robotic workcells verification and off-line programming

### Benefits
- Increase manufacturing quality, accuracy and profitability
- Reduce labor hours and process engineering lead time
- Optimize development and capital investment
- Better use production equipment
- Reduce production costs
- Shorten ramp-up time by introducing validated and mature processes
- Accelerate time-to-market

### Features
- Interoperability with major MCAD systems
- Robots, machines, tools and equipment libraries
- Modeling of components
- Modeling of complex kinematics of robots and other mechanisms
- 3D layout definition of workcells
- Robotic and assembly path definition with reachability check, collisions detection and optimized cycle time
- Motion simulation and synchronization of multiple robots and mechanisms

### Summary
Robcad enables the design, simulation, optimization, analysis and off-line programming of multidevice robotic and automated manufacturing processes in the context of product and production resource information. It provides a concurrent engineering platform to optimize processes and calculate cycle times. With Robcad, you can design life-like, full-action mockups of complete manufacturing cells and systems on 3D graphics computer workstations. Robcad enables manufacturers to flawlessly introduce automated processes by allowing manufacturing engineers to virtually validate automation concepts upfront.

### The business value of Robcad
As a scalable solution, Robcad fully integrates core technologies with a powerful set of process-specific applications for a wide range of processes, including spot welding, arc welding, laser- and water-jet cutting, drilling and riveting and human operations.

Robcad is an industry de facto standard, with thousands of seats in production engineering, helping users improve manufacturing processes by cutting costs, increasing quality and accelerating time-to-market.

Robcad serves manufacturing process design teams, including contractors and their supply chain, as well as service companies (system integrators and design houses) within automotive, aerospace, utilities and heavy industries.
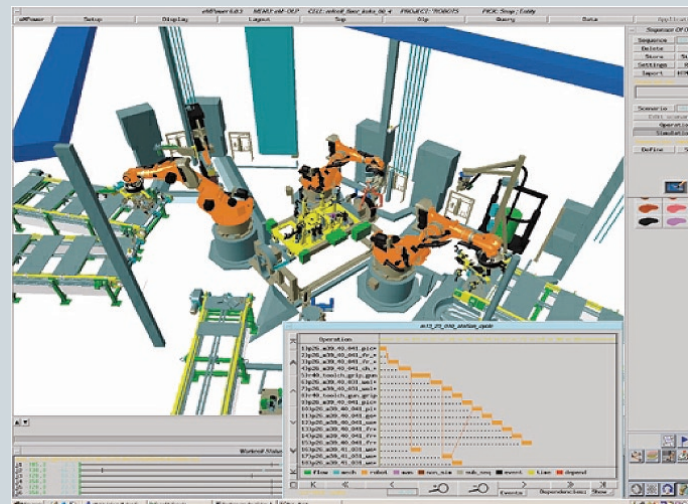


# TECNOMATIX

## SIEMENS

# Robcad

**Features** *continued*
- Modeling and optimization of the whole manufacturing process and SOPs
- Off-line programming
  Optimized programs downloaded to robots on the shop floor
  Uploading existing production programs for optimization

**System requirements**
Robcad supports various hardware platforms:
- Windows 2000 and XP PCs
- SGI Unix workstations
- HP Unix workstations
- Sun Unix workstations

**Graphic environment for analyzing, optimizing and verifying manufacturing automation**
Robcad facilitates better and more reliable decisions upfront, significantly reducing capital investment, planning and assembly times. It allows process design engineers to graphically study and manipulate workcells that can then be analyzed, optimized and verified before users invest in costly production machines or equipment.

Robcad simultaneously models all physical characteristics of robots and other automated devices, enabling users to verify the accessibility limits (reach target, define path, avoid collisions and calculate cycle times) while developing a planning concept.

Preliminary setups of automated production can therefore be designed before launching the manufacturing process.

**Interoperability with CAD systems**
Robcad fully integrates with most industry MCAD systems, including native data from Catia, NX™ software, Pro/Engineer, NX I-deas® software, CADDS5, direct CAD interfaces or neutral formats such as JT™, IGES, DXF, VDAFS, SET, STL and STEP.

Interoperability with MCAD data models enables the verification of the product together with the manufacturing process.

Robcad can handle very large volumes of data, enabling the simultaneous modeling and coordination of many automation tasks.

**Workcell layout design and modeling**
In addition to providing the most comprehensive library of robots available, Robcad facilitates easy modeling of additional robots and mechanisms.

Robcad layout features enable the design and construction of 3D environments. Once a process has been designed with Robcad, its robotics capabilities enable robot reachability checks.

**Motion simulation for robots and mechanisms**
Robcad generates configurable motion plans based on the controller features. It allows calculation of cycle times, analysis of real-time performance and saved testing time.

The RRS (realistic robot simulation), which is based on using the real controller motion planning software, offers extremely accurate cycle time calculation.

**Collision detection**
Robcad can dynamically detect collisions during robot simulation and motion, preventing costly damages to equipment.

**Sequence of operations (SOP)**
Robcad facilitates the description and sequencing of all operations and tasks performed with production resources (e.g., robots, mechanisms, humans). This capability enables the visualization and optimization of the entire workcell cycle.

**Off-line programming (OLP)**
Robcad OLP enables accurate simulations of robot motion sequences and the delivery of machine programs to the shop floor. Robcad interfaces to most robots (50+ standard interfaces representing over 200 controller configurations), adjusting the program to all specifications of the controllers. Controller-specific information, including motion and process attributes, can be added to the generated robot paths. Robcad OLP then generates the controller program, which is then downloaded to the real controller.



*Off-line programming.*

Programs can also be uploaded for re-use and optimization.

Standard and customized Robcad interfaces enable minimum touchups and more efficient off-line programming.

Robcad can generate the most suitable combination of equipment to meet specific manufacturing requests, allowing faster product introduction and early evaluation of manufacturing times, costs and project investments. Equipment can then be used exclusively for production and not wasted on program development.

## Robot calibration improves positioning accuracy

Robcad provides calibration functionalities to accurately align digital cell models with actual layouts. After downloading the program, the robot will accurately move to defined locations in the cell without need for touchups.
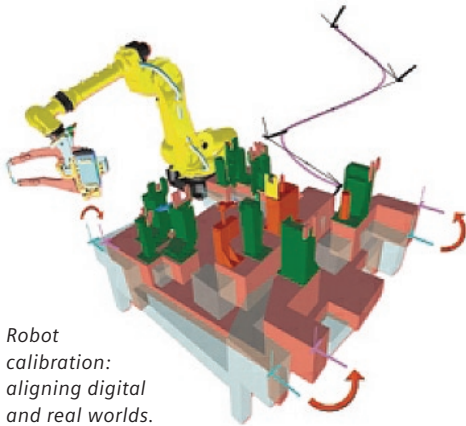


*Robot calibration: aligning digital and real worlds.*

Robcad also interfaces with other calibration tools, including those from Dynalog (www.dynalog-us.com) and Krypton (www.krypton.be).

## Open system environment for customized program functions

The Rose Development Kit offers an open system environment for developing customized features and applications. It enables easy, fast and efficient programming and provides high-level access to all Robcad proprietary core technologies and algorithms, including geometry, kinematics, motion planning and graphics.

Additionally, it is possible to develop macros or prototype applications.

## Automatic path planning

Robcad generates collision-free robot and part assembly paths by using automatic path planning technology.

In a populated environment, the trajectories can be found easily and automatically, helping to increase user productivity.

## Reporting

Editable HTML reports about cells, BOMs and SOPs are available. Contents include images and data extracted from the workcells, with subreports for robots, guns, devices, non-kinematics components, human models, paths, weld points, jpeg graphical views and VRML2 animations.

Robcad can also generate drawings of cell layout and animated movies.

## Integration with virtual reality tools

Virtual technology enables users to create intuitive simulations. Users can navigate graphically within the Robcad digital workcell's environment by using virtual reality technologies to export graphics, simulation and collision detection.
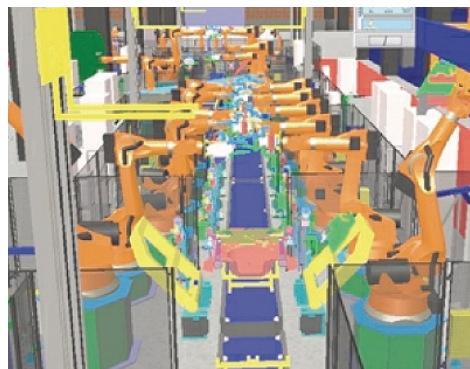


*Virtual reality integration.*

Robcad supports a variety of virtual reality equipment such as VD2 (VRCom) and Invision (Intro).

## A key component in digital manufacturing

Digital manufacturing comprises all the technologies and methodologies for collaborative development and management of manufacturing process information – much as traditional methodologies help manage product information. Digital manufacturing provides links between upstream product lifecycle management (PLM) software, such as computer-aided design (CAD) and product data management (PDM) systems and downstream applications, such as enterprise resource planning (ERP).

Robcad is an integral element of the Tecnomatix® Assembly Planning software solution allowing users to exchange layout (resources and parts) and process information with the manufacturing backbone. This integration increases and optimizes the level of collaboration and synchronization between process planners and simulation engineers.

## Spot welding

Robcad Spot Weld addresses the entire spot-welding design process, taking into account such critical factors as space constrictions, geometric limitations and welding cycle times. Powerful features such as gun search, automatic robot placement, path cycle-time optimizers and weld-point management tools enable users to create virtual cells, simulations and programs that accurately reflect the physical cell and robot behavior. Robcad
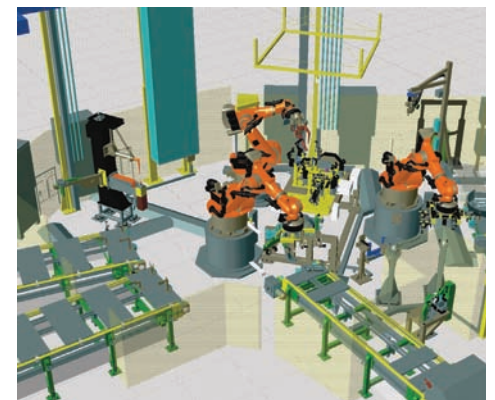


*Spot welding.*
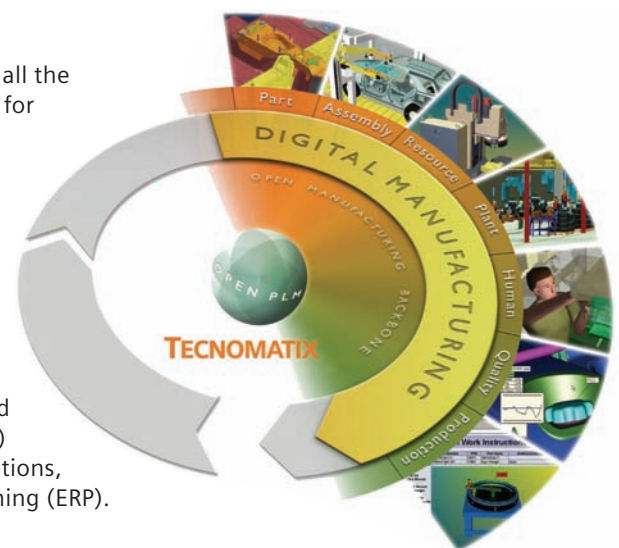
Spot Weld also enables efficient off-line programming of robots, shortened production ramp-up time and optimized introduction of new products or variants without having to stop the welding line and lose production time.

### Arc welding

Robcad Arc Weld enables the design, simulation, analysis and off-line programming of arc-welding processes. It facilitates creation of workcell layouts based on definitions of robot motions, seams, gantries and welding equipment. Seams are created based on the part geometry and qualified welding procedures. Tooling can be verified according to torch access. Torch orientation, gantry and positioner settings can be optimized to ensure collision-free access, robot reach and optimized welding conditions. The welding sequence can be defined and optimized to limit part deformations and minimize cycle time. Complete, fully proved programs can be downloaded to equipment on the shop floor, minimizing production downtime. The same welding paths can be easily adjusted and transferred to various equipment available in the factory.
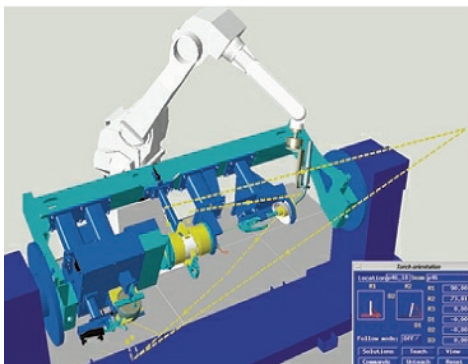
### Painting, sealing, gluing, sand blasting, shot peening, flaming and thermal spraying

Robcad Paint provides software tools that address the entire spraying process: designing the robot path, verifying access to all areas, determining coverage parameters and thickness, creating and adjusting process triggers, simulating and downloading the optimized program to the shop floor.

For the painting process, Robcad Paint supports robots and painting machines using conventional or electrostatic spraying. Its comprehensive functionality, combined with the opened and configurable thickness calculation function, enable its implementation for other spraying processes, such as sealing, underbody sealing, gluing, sand blasting, thermal plasma spraying, shot peening and flaming.
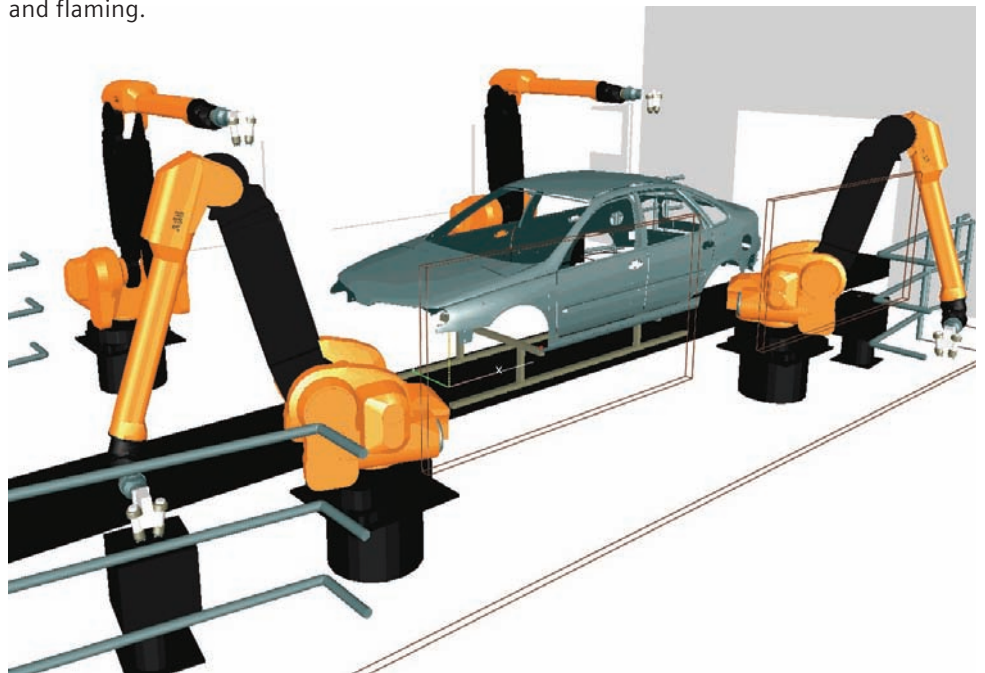
### Drilling and riveting

Robcad facilitates the programming of drilling and riveting machines for aerospace industry applications. Users can define a large amount of drilling and riveting points for fixing the fuselage envelope on the plane structures.

An optimized path connects these points to minimize the robot or machine motion. The entire environment is simulated, including the drilling and riveting effectors and anvils. The anvil can be reoriented in order to ensure collision-free access. An optimized and fully proved program can then be downloaded to the machine, avoiding time-consuming onsite verifications.



*Arc welding.*



*Painting.*

**Laser, water-jet and plasma cutting**

Robcad Cut and Seal provides software tools that enable automatic creation of complete contours by simply clicking a single curve or single surface. Geometric flaws such as gaps can be accommodated. The contour is converted into linear, circular and spline motions, with the orientation always kept normal to the surface; the tool compensation feature allows tool diameter to be taken into consideration.

Orientation can be easily manipulated with advanced tools to handle singularities (sharp corners), to manage wrist config-uration and optimize motion (offset wrist with 5-axis machines, 6-axis robots) and to automatically avoid collisions with the part. After sequencing the paths, an optimized and fully proved program can be downloaded to the machine or the robot.
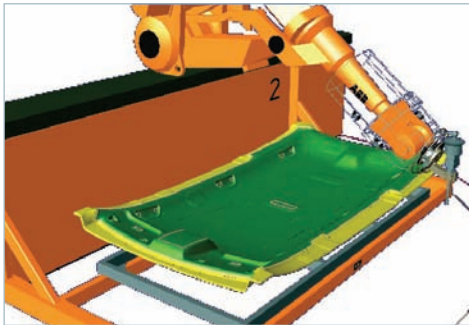
**Polishing, grinding and deburring**

Robcad enables the creation of finishing paths based on the part geometry. Paths can also be imported from a CAM system, enabling visualization and simulation of the entire environment, including tool changers and positioners, robots or NC machines. Path orientations can be modified to ensure easy, smooth and collision-free access with reduced wrist motion. Positioner angles can be defined and optimized to improve the process. Tool penetration can be visualized (polishing) while the robot follows its path. A complete, optimized and fully proved program can be downloaded to the machine.



*Laser cutting.*

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