Simulation Based Design of Manufacturing Systems

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Dassault Systemes
Close to Market
Smaller
Made to Order
Challenges for Manufacturing

- **Access** the latest design data
- **Increasing** number of variants
- **Implement** Production Standards
- **Safety**
- **High cost of late fixes**
- **Produce** high quality parts
- **Flexible automation**
- **Too much time programming**
Technology Trends are Creating Opportunities

Platform Based Engineering

Product Design  Tool / Fixture Design  Process Design  Plant Layout  Process Simulation Machine Programming
Plant Layout Design

**Objectives**
- Define the layout of the factory
- Be able to start from an existing line (layout 2D)
- Usage of standard library, components catalog, parametric resources
- Export 2D drawing

**Values**
- React quickly to a change with all the manufacturing information captured in the same repository (product, assembly planning, line definition, bill of resources, etc.)
- Reduce planning errors, improve quality of resource planning and optimize the resource planning
Assembly Definition & Validation

**Values**
- Direct access to product data helps to keep the planner's work in sync with engineering by using change management tools
- Easy-to-use check capabilities available to identify missing parts and unplanned fasteners
- Early feedback to design
- Upfront assembly process feasibility in 3D

**Objectives**
- Analyze and define the configured manufacturing assemblies of the vehicle
- Analyze the fasteners and assign them to various assemblies based on the part to fastener relationship created by designer
- Create the MBOM structure solved in effectivity configuration (variant and evolution)
- Export the results into various formats
- Taking into account information provided by designer with regards to engineering requirements.
- Use standard process templates

- Access product structure with parts, fasteners and date information to create the assembly graph of the product
- Create various intermediate assembly steps, assign parts and fasteners taking into account the geometric constraints
- Use change management to be in sync with design evolutions
Sequence & Cycle Time Validation

Objectives
- Create a first multi-cycle simulation of the station and line to validate the cycle times feasibility using the work done by capacity planning
- Create Input / Output connection between different control devices
- Create Station / Line simulation state
- Validate conveyors and buffers

Values
- Validate the cycle times specified at the planning stage
- Validate the resources / device synchronization

• Convert the time charts defined at the planning stage into advance logical sequence for each resource, station and line
• With the simulation in 3D get a first validation of the feasibility of the cycle time
Tool Accessibility Check

Objectives

- Check the **reusability of existing fastening tools** by validating accessibility
- **Automated tool accessibility checking** to improve efficiency
- **Provide feedback to engineering** on critical steps and modifications required
- Create sectional views of the **new tool requirement** as input for the designer
- **Tool behavior** is taken into account

Values

- Significant cost reduction in identifying how many existing tools can be reused for the next program
- Minimize the number of spare tools for maintenance
- Assists the planner by providing early feedback to design team on critical issues
- Analysis tools help in getting rid of empirical ways of finding the best suitable tools
Resource Planning

Objectives

- Define the logical & rough physical views of the (line, station, cells, robots ...) with the associated product flow per site
- Reuse stations from libraries of former programs
- Define how the parts and assemblies are loaded along the assembly line
- Re-allocate fasteners across stations based on robot capacities to meet cycle time
- Easily accommodate multi model and multi site
- Resource balancing to optimize resource utilization

Values

- Get quickly a global view of the resources
- Verify the product flow
- Finalize resource allocation for each station and generate reports
- Rebalance the complete line based on constraints and optimum utilization of resources
Line/Station Validation

Objectives
- Assure the fastener accessibility
- Robot positioning
- Tool validation
- Tool attachment definition
- Validation of the robot load
- Refine robot trajectory of welding and handling

Values
- Validate the fastener distribution in the tooling context before robot OLP
- Process verification including extraneous robot cycles (maintenance, quality, etc)
Objectives

- Perform static reachability studies for the cell and create the robot paths for the specified task
- Validate the robot paths within the station context (robot dress, tooling, fences, etc.)
- Validate the station/line takt time in a mixed model situation
- Connect to RRS and validate the cycle time
- Calibration and offline programming

Values

- Develop and optimize the robot programs based on planning information or from the existing line
- Validate the resource operations and time in the station environment
- Automatic and fast computation of robot trajectories speeds up assembly and spot-welding planning

• Perform reachability studies and create programs for robots with automated stations and mimic behavior of human for manual welding stations w.r.t to ergonomics
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Resource Program Development

• Perform reachability studies and create programs for robots with automated stations and mimic behavior of human for manual welding stations w.r.t to ergonomics
Accelerate time to market

...by validating and programming production systems during the product design phase

“Production engineering can’t keep up with all the changes”

... Single source of truth Everyone works with the latest design data

... Manage design changes with graphical reconciliation of parts and fasteners

... Engineer concurrently and begin production engineering sooner
Increase production and maximize resource utilization

...with offline programming of your robotic systems

“We risk production down time whenever we implement a change”

... Program robots for the next product while production keeps running

... Balance operations between robots and make every second count

... Perform what if analysis and implement best practices

... Maximize floor space and protect capital expenditures
Standardize and reuse existing processes and resources

... from one product to the next

1+1=2

“Every project we learn something new”

... Validate that tools work and reduce tool inventories

... perform what-if scenarios and store the best ones

... Create best practices and re-use them again and again