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Siemens PLM Software

Tecnomatix Variation Analysis

Predict and reduce the impact of variation on product dimensional quality

Benefits
- Identify dimensional problems due to excessive variation early in the design cycle, reducing the need for engineering changes
- Clearly identify and quantify variation causes and contributors in a robust 3D environment
- Create feature-based models before or after geometry is available (creating models prior to geometry will help drive the design before parts are made or tooling is cut)

Features
- Use the Teamcenter lifecycle visualization capabilities to analyze assemblies with thousands of parts in a graphically rich, CAD-neutral environment

Summary
Tecnomatix® Variation Analysis software (formerly VSA) is a powerful dimensional analysis tool used for simulation of manufacturing and assembly processes to predict the amounts and causes of variation. Variation Analysis can help reduce the negative impact of variation on product dimensional quality, cost and time-to-market. The foundation for Variation Analysis lies within the Teamcenter® software lifecycle visualization suite, allowing users to leverage the digital prototyping and visualization capabilities of both the mockup and professional solutions.

Ensure parts fit and work properly together the first time
With Variation Analysis, a 3D digital prototype is created to simulate the production build process. The digital prototype includes a comprehensive representation of geometry, product variation (tolerances), assembly process variation (sequence, assembly attachment definition, tooling) and measurements. The model is used to predict if there will be any assembly build problems – before any physical parts are made or tooling is cut. It also identifies the root causes of the build problems and enables the design, tolerances and assembly process to be optimized very early in the product development process.

Business value

Optimize product and process
Variation Analysis allows users to identify dimensional problems early in the design cycle, avoiding assembly build and quality issues due to excessive variation. With this solution, design flaws can be caught before committing to tooling.

Identify critical dimensions
Variation Analysis identifies critical dimensional, tolerance and assembly processes that are key contributors to variation. These areas have a significant impact on product quality and therefore warrant careful monitoring.

Reduce costs
Variation Analysis reduces cost by improving product quality and accelerating time-to-market. In addition, manufacturing costs can be reduced by maximizing allowable part tolerances, while still controlling

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Features *continued*

- Identify tolerances and assembly processes that contribute to variation and perform quick what-if analyses to optimize tolerances, design and the assembly process

- Manage analysis and results in Teamcenter

- Apply variation using a variety of tolerancing methodologies, including GD&T

- Leverage the powerful ConJoin assembly solver to determine if assembly processes are either constrained too much or too little

- Incorporate component flexibility through linking with finite element analysis results

- Generate a variety of graphical reports tied to 3D geometry for an individual measurement or a group of measurements

- Extract and validate PMI from various authoring sources via the industry standard JT data format

- Add manufacturing capability data into Variation Analysis for real-time root-cause analysis of production build problems

critical assembly dimensional specifications. Controlling these dimensional characteristics helps minimize scrap, rework and warranty defects. With Variation Analysis, product quality is significantly improved by ensuring that parts fit and work together properly the first time.

Technical solution overview

Teamcenter lifecycle visualization suite
The Teamcenter computer-aided design-neutral lightweight visualization environment allows the geometry from multiple sources to be included in the analysis. In addition, this enables the analysis of large assemblies and leverages many of the digital mockup capabilities such as cross section, 3D clearance/markup/measure, etc.

Geometric tolerancing capability
Variation Analysis supports feature-based modeling with the features varied based on geometric dimensioning and tolerancing (GD&T). Key tolerancing aspects supported include maximum material condition, composite position and profile, multiple datum reference frames and unilateral/unequal bilateral surface profile.

ConJoin assembly constraint engine
ConJoin is an equation-based, generic assembly solver for the full range of static and kinematic assembly constraints using a single common user interface.

Flexible component capability
Through integration with many finite element analysis (FEA) solvers, Variation Analysis can be used to comprehend component flexibility due to clamping, welding and springback.

The competitive advantage
No other dimensional analysis solution on the market:

- Works in a CAD-neutral, graphically rich digital prototyping environment

- Provides feature-based capabilities using tolerances based on GD&T

- Supports static and kinematic assembly operations within the full range of allowable constraints

- Links to FEA solvers for comprehension of component flexibility