Tolerance Analysis and Dimensional Management (TADM)

By Analysis Express
Analysis Express (AE) is recognized for its expertise in Advanced Analytics, Big Data, Business Intelligence, Data Warehousing and Professional Services. Founded in 2004, AE has implemented Analytics solutions for numerous Fortune 500 companies.

Relying on its broad experience and expertise, AE has created custom software solutions in several industry verticals. For engineers, AE offers a unique software solution called TADM.

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What is TADM?

The TADM System is the world’s most advanced tolerance analysis management software. Its approach is a paradigm shift that replaces manual intensive processes.

The TADM System seamlessly integrates all aspects of tolerance analysis—from design, to manufacturing, to quality engineering. The System manages and automatically updates part-design, actual inspection data, and tolerance analysis results to drastically improve design process efficiency by connecting the dots in-between CAD design, manufacturing and quality assurance.
TADM Solves Typical Tolerance Analysis Problems

Does this sound familiar to you?

- Tolerance stacks are a time intensive manual excel task
- Upkeep of the tolerance analysis is an increasingly time intensive process whenever changes are made to the design
- Hard to spot design errors upfront within released drawings
- Verification with inspection data is yet another manual time intensive process
TADM is the solution!

- **Eliminating tedious manual hours** (and errors) of creating, maintaining and updating tolerance stacks
- Keeping track of version changes in part design; and **automatically updating** the stacks affected by the change
- **Cutting down manufacturing cost** by identifying non-critical tolerances
- **Shortening design cycle time** with First Article data compared to actual design values
- Giving the ability to analyze stacks using it’s “**What If**” Scenario and Monte-Carlo analysis
- Taking a short-cut in part design cycle with the help of its “**virtual**” part capability
TADM Features Overview

• TADM is **integrated with Excel** to take advantage of it’s already familiar, intuitive features
• Calculated Parts – A Paradigm Shift
• Centralized **database system saves time** by ensuring the same revision level is used by all engineers
• Tolerance stack **updates are automatic** when part revisions are made
• Fully Incorporated **GD&T Features**
• **Analytical and Statistical Analysis** including: Worst Case, RSS & Modified RSS calculations
• Integrated First Article Inspection Forms
• Attach Drawings/Pictures to tolerance stacks
• Integrates with 3rd party software: (BCT, enventive)
• Smart device integration using **iOS App**
## Market Survey

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<th>CAD Integrated Tools</th>
<th>Dedicated tools (Mathematical Advantage)</th>
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Features Walk-Through

Features Highlights:

- **TADM Excel Interface**.........................p8
- **Automatic Stack Updates**......................p10
- **Fully Integrated GD&T**.......................p11
- **Advanced Analyses**............................p12
- **Calculated Parts: A Paradigm Shift**.........p14
- **First Article Inspection**.......................p16
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The interaction interface of TADM software is intuitively simple and common – its Microsoft Excel. Studies have found that most design engineers use Excel to perform tolerance stack-up & analysis.
The process of creating a new stack starts with filling out a simple Excel based form. The only inputs in this form are the part names and dimension numbers - the rest is filled out automatically by the TADM system. The results are calculated instantly as the parts are entered.
Automatic Stack Updates

TADM system uses a central data repository to standardize design requirements, inspection data and tolerance analysis.

The benefits of this centralized system:
- Automatic detection and updating of modified dimensions
- Detections of stack containing modified dimensions
- Automatic updating of stacks & results
- Reduces the chance to make mistakes by reducing manual intervention
- The same Revision Level is used by all engineers
Fully Integrated GD&T

- TADM System includes fully integrated GD&T requirements into its formula database

- Predefined rules and formulas are applied and automatic calculations can be completed depending on the chosen feature control
Advanced Analyses

TADM-System is far more than a standard tolerance analysis solution. The application provides advanced and powerful tools to fine tune Tolerance Analysis for higher accuracy and better cost-effectiveness. Some of these advanced tools are as follows:

- **“What-If” Analysis** allows the engineers to realize possible impacts on the current stacks and/or all existing stacks if changes are made to the design

- **Sensitivity Analysis** allows user to quickly recognize how each component/part can have impacts against other components/parts on the same tolerance stack

- **Monte Carlo simulations** allows users to perform advance statistical Tolerance Analysis on the tolerance stacks
Monte Carlo simulations allows users to perform advance statistical Tolerance Analysis on the tolerance stacks whose components / parts may have different levels of process capabilities and on the non-linear tolerance stacks whose standard RSS method cannot provide accurate results.
Calculated Parts - A Paradigm Shift

Within TADM, calculated parts are conceptual or virtual parts. The typical design cycle starts with CAD design. Then measurements from the CAD design are used to analyze tolerance. At this time, if a fault is discovered or even a design change needs to be made, the only solution is to start the cycle back up from the CAD software. This is time consuming. Calculated parts are a paradigm shift from traditional processes, allowing engineers a much faster way to finalize a design.

Details:
- A Calculated part can be used in any stack-up just like other parts that came from CAD design.
- The user has freedom to use any formula for the resultant
- Saves costly design time during initial phases of Research & Development (R&D)
- The part can include non-dimensional data such as FEA results, test data and actual metrology data
- Allows for complex part behavior such as angle and movement
- A Calculated part can contain other calculated or CAD design parts
A Calculated Part may contain one or more Calculated Parts and CAD defined real parts, complex angle, and motion formulas—thus making it an ideal choice to try-out a labyrinthine of what-if scenarios during tolerance analysis.
First Article Inspection

Another major benefit from this system is that First Article Inspection (FAI) data can be stored, managed and assessed easily

• Forms can be sent to suppliers and filled forms can be imported into the central database
• Data can be used for ‘What if’ analysis
FAI reports can be prepared with a click of a button. Suppliers can fill in the inspection data quickly. Then the data can be imported and stored back to the central TADM warehouse allowing the engineers to compare and simulate the tolerance stacks with the FAI data and the original design requirements. This helps engineers manage non-conforming requirements, relax tight tolerances on non-critical parts to cut the manufacturing costs, and also reduce design cycle time with the as-built FAI data incorporated into the design process.
Compatibility with BCT & Enventive

• Can import data generated by drawing Ballooning softwares like BCT
• Can link and update dimensional and tolerancing information from Tolerance analysis and modelling software
Iphone App

Dashboard reporting and high level summary information is available via TADM app for iPhone users. This complimentary software module lets essential and critical information at the fingertip when a full version of the software is not needed.
Case Study: Ethicon, Inc

**CHALLENGE**
Ethicon Inc. (A Johnson & Johnson Company) faced difficulties when trying to maintain, update and synchronize tolerance analysis information for its precision medical devices. The information needed to be accessible, up-to-date and transparent across different levels within the company and supply chain.

**SOLUTION: TADM System**
Ethicon implemented the TADM System in a phased implementation over the last 5 years, with these following key benefits to be expected and measured.
Little or no learning curve.
Drastic reduction in manual effort
Advanced, sophisticated database driven process to augment standardization, conformity and error correction among other things.
Availability of advanced features e.g. inspection data management and what-if analysis helps engineers manage non-conforming requirements and detecting impacts at a much faster pace.
Level of confidence in all aspects from initial design to production since the requirement is driven by highest of quality demanded

**VALUE**
The TADM System has received corporate wide acceptance because it provided a more efficient way to manage tolerance analysis and greatly reduce design cycle time. TADM system’s centralized design and integrated feature set including: calculated parts, incorporated GD&T requirements, inspection data and “What If” functionality have provided considerable time-savings.

**Estimated Time Savings vs. Compared to Manual Methods**
60% Construction, 90% Upkeep, 80% Analytics
“Ethicon-Endo Surgery is constantly challenged with maintaining numerous tolerance stacks. TADM-System has shown a major efficiency improvement to the design process by utilizing automatic updates to tolerance analysis when changes are made to the design.

The system detected incorrect engineering designs right after release, instead of months later and with just that, the implementation cost of this system has been justified”

Research Director, Ethicon-Endo Surgery
Our Process & Approach for TADM Success

Value Assessment
- Introduce TADM through initial client meeting highlighting key facts, features and benefits.
- Trial/Demo TADM with client for first hand experience
- Determine if TADM is a viable solution for the client
- Begin Cost Analysis and Implementation requirements

Implementation Solution
- Customize TADM for clients needs and expectations
- Manage TADM software system implementation and customizations
- Optimize and integrate TADM for clients operational environment
- Test
- Training
- Perform User Acceptance Test
- Go Live!

Support & Maintain
- Mentor our clients on how to take the next steps with TADM system
- Provide Periodic TADM enhancements and improvements
  Provide engineering talent to improve client’s efficiency
Contact Us

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