Raising the Value of your Product Data

CAD Model Verification, Validation and Comparison

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**Background**
- Founded in 1983 by Dr. Jason Lemon
- Privately Held
- Headquarters - Cincinnati, OH

**Global Presence**
- North America
- Europe
- Asia Pacific

**Business Offerings**
- Engineering Process Improvement Consulting (CP/PD™)
- Analysis, Simulation, Test, and Reliability Engineering Services
- *Product Data Integration & Interoperability (TranscenData Business)*
Engineering is hard . . .

Sharing your product data should be easy!

Solution Set
- CAD & PLM Integration
- PLM & ERP Integration
- CAD Model Quality, Translation & Distribution
ITI Transcendata History

- Mid 80s
  - IGES Translator Development
    - Vendor/OEM Programs
    - IGES Standard Development Effort
    - IGESworks

- Early 90s
  - PDM Systems Integration
    - Vendor/OEM Programs
    - PDM/CAD & PDM/ERP
  - Quality Testing and Repair
    - Acquired FEGS Ltd. with CADfix
    - CADIQ
  - Automation & Comparison
    - DEXcenter
    - CADIQ V4
  - STEP Translator Development
    - Vendor/OEM Programs
    - STEP/PDES Inc. Development Effort

- Late 90s
  - PDM Systems Integration
    - Vendor/OEM Programs
    - PDM/CAD & PDM/ERP
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  - STEP Translator Development
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- Today
  - PDM Systems Integration
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CADIQ Product Overview

- Native CAD Interfaces (API)
  - CATIA V4 and V5, I-dea, Pro/E, SolidWorks, Unigraphics
  - Parasolid, STEP and IGES

- Specialized User Interface
  - Multi-CAD, multi-platform batch analysis with statistics
  - Rapid graphical viewing of diagnostic feedback
  - Side-by-side viewing of 2, 3 or 4 equivalent models

- Model Quality Diagnostics
  - Invalid geometry
  - Unrealistic/ambiguous features

- Model Comparison Diagnostics
  - Unacceptable changes after translation
  - Undocumented changes between revisions
  - Unintentional changes between revisions

- System Integration Options
  - Embedded CAD utility
  - DEXcenter
  - PDM Workflow
CADIQ Software Architecture

- Sampling points are evaluated by the native CAD system.
- Only topology & sampling points are translated by CADIQ between the CAD systems.
- Point projections are performed by the target CAD system.
- Quality analysis is performed on each model in its own CAD system.
Design Verification for Simulation: Unrealistic Blend
Design Verification for Simulation: Crack Between Rib and Body
Diagnostic Correlation Statistics

- Identify good (OK) and bad (NOK) models for a specific downstream process
- Determine which diagnostics are significant
Quality Control Statistics

- Classify a model for downstream reuse
  - “Concept model” vs. “Engineering model”
- Summarize the quality of the CAD models for a specific design project
Quality Control Statistics (cont)

- Track the quality of the models in a project over time
  - Severity: Defect, Warning or Clean (for downstream reuse)
  - Type: Parametric or Explicit (no features/history)
Expanding the Definition of “Bad CAD”

- **Invalid geometry (Verification)**
  - Impedes reuse of native model in most CAx processes

- **Unrealistic features (Verification)**
  - Require geometry changes during CAE/CAM model reuse
  - Can cause divergence between CAE and CAM models

- **Unacceptable changes (Validation)**
  - Introduced during translation, migration, remastering or archiving
  - Introduced during rework for CAE/CAM reuse

- **Undocumented changes (Comparison)**
  - Between design revisions or for an engineering change order

- **Unintentional changes (Comparison)**
  - Between design revisions or for an engineering change order
  - Caused by complex parametric relationships unknown to user
Direct Translation Validation: Shape Change in Complex Blends
Feature Translation Validation: Feature Dropped with No Error in Process
STEP Translation Validation:
Surface Approx. Creates Open Solid
Comparing Part Revisions
Comparing Part Revisions: Fillet Radius Increased
Comparing Part Revisions: Small Feature Suppressed
Comparing Part Revisions: 
Hole Diameter Increased
Design Verification for Simulation/Tooling

“Minimize CAD rework for simulation.”
Translation Validation

- Verify native model for downstream reuse
- Validate that translated model has equivalent quality and shape
- Identify process issues for Support to resolve

“Document geometric changes since the previous translation.”

“Quickly identify and resolve translation process problems.”

CADIQ Functions
Validation for Long-term Preservation

- Verify native model for downstream reuse
- Validate that STEP export has equivalent quality and shape
- Validate that STEP import has equivalent quality and shape

“Your long-term revenue is dependent on long-term preservation of your digital data.”
Proprietary vs. STEP-Based Validation

Current proprietary solution

CAD Session A
CADIQ Analyzer
CAD File A
Translation, Migration, Remastering or Archival
CADIQ File
CAD Session B
CADIQ Analyzer
CAD File B

Potential STEP-based solution

CAD Session A
CADIQ Analyzer
CAD File A
Translation, Migration, Remastering or Archival
CADIQ File
CAD Session B
TBD Analyzer
STEP VP & PDQ File
10 to 70 years

“Create a self-validating STEP archive model.”
New STEP Development Activities

- **CAx-IF Validation Properties Recommended Practices**
  - Extend STEP to capture native validation properties
  - Developed in 1998 by CAx Implementers Forum (mass props only)
  - Supported by most STEP translation vendors
  - Extended in 2001 to include assembly part-instance mass props
  - Supported by a few STEP translation vendors
  - 2\textsuperscript{nd} extension proposal being developed to add face sampling points

- **ISO 10303 Part 59 “Quality of Product Shape Data”**
  - Extend STEP to capture native geometric quality data
  - Based on SASIG (VDA, JAMA/JAPIA, AIAG) PDQ specification
  - Proposed by Japan at fall 2004 ISO meeting
  - Working draft delivered at fall 2005 ISO meeting
  - Targeting completion in fall 2006 for AP203 Edition 2
Raising the Value of your Product Data

- Ensure CAD Model Quality
- Maximize CAD Model Re-use
- Facilitate Global Product Development
- Enable Engineering Supply Chain Data Exchange

Product Data Integration & Interoperability Solutions

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