QIF and the Future of Digital Metrology

Daniel Campbell
Capvidia
dc@capvidia.com
Overview

- Current metrology process
- What is QIF?
- QIF use cases
- Capvidia and QIF
Modern Software Process: Manufacturing

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Current State-of-the-art:
- Fully associative master-model driven technical package
- Supports complex NC processes
- Promotes data re-use

Design -> Machine Setup -> Tool Path -> Post Processor -> CAM Process Verification

- Master Model
- Fixturing
- Stage Operation
- Tooling
- Operation
Typical Metrology Software Process

Current State-of-the-art:

- **Adequate** GD&T representation not available: robust, semantic PMI required
- Downstream metrological applications exist, but lacking GD&T cannot associate back to master model
Typical Metrology Software Process

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Even hand-written inspection reports are not uncommon

Problems:
- Transcription errors
- Weak traceability
- Data are unavailable to software
Quality Information Framework (QIF)

Feature-Based Ontology of Manufacturing Quality Metadata

XML Technology: Simple Implementation and Built-In Code Validation

Data semantically linked to Model for pure MBE implementation
Quality Information Framework (QIF)

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QIF Statistics
Statistical process control using QIF

QIF MBD
CAD and PMI data

QIF Plans
Bill of Characteristics ("what") and Measurement Plan ("how") data

QIF Resources
Measurement Resource information

QIF Rules
Measurement templates, macros, and best practices

DMIS
ISO/DMIS 5.3 is fully linked to QIF

QIF Results
Measurement result data

QIF Library
A Simple, Unified QIF Workflow

Authority Model
A Simple, Unified QIF Workflow

Generate QIF Model
CAD + PMI

Authority Model

QIF MBD
A Simple, Unified QIF Workflow

Authority Model → Generate QIF Model → QIF MBD → Augment data: Measurement Plan → QIF Plans → QIF MBD

Generate QIF Model
CAD + PMI

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A Simple, Unified QIF Workflow

Generate QIF Model

CAD + PMI

Augment data:

Measurement Plan

QIF MBD

QIF Plans

Augment data:

Measurement Results

QIF Plans

QIF MBD

QIF Results

QIF Results

QIF Results

QIF Results
A Simple, Unified QIF Workflow

1. Authority Model
2. Generate QIF Model
   - CAD + PMI
3. QIF MBD
4. Augment data:
   - Measurement Plan
5. QIF Plans
6. Augment data:
   - Measurement Results
7. QIF MBD
8. Augment data:
   - Statistics
9. All data linked to authority model
10. QIF MBD
11. QIF Plans
12. QIF MBD

QIF Statistics
- QIF Results
- QIF Results
- QIF Results
- QIF Results

QIF Plans
- QIF Results
- QIF Results
- QIF Results
- QIF Results

QIF MBD
- QIF Results
- QIF Results
- QIF Results
- QIF Results

5/5
Live demonstration of QIF workflow with these software providers

Learn More: http://qifstandards.org/imts-2016-qif-demonstration/
Example Workflow – CMM Automation and Optimization

Click here to watch the video
DMDII Project: Automatic Generation of Optimized CMM Programs on the DMC

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“Black Box” Software System on Digital Manufacturing Commons

- Extract Bill of Characteristics
  - Query semantic relationships of features and GD&T
  - Convert to QIF MBD

- Optimize Measurement Plan
  - Generate optimized measurement plan from CAD + PMI and available resources

- Generate Inspection Program
  - Analyze feature accessibility and choose workpiece orientation
  - Generate CMM clearance paths

QIF Enabled Workflow

CAD + PMI IN

Inspection Program OUT
Example Workflow – Supply Chain Control

Technical Data Package
• Native Model
• ...
• Certified QIF MBD
• QIF Plans (BOC)

OEM

Supply Chain
Example Workflow – Supply Chain Control

Technical Data Package
- Native Model
- ...
- Certified QIF MBD
- QIF Plans (BOC)

QIF Plan
Bill of Characteristics

Supplier 1
Supplier 2
Supplier 3

OEM

Supply Chain
Example Workflow – Supply Chain Control

Technical Data Package
- Native Model
- ...
- Certified QIF MBD
- QIF Plans (BOC)

QIF Plan
Bill of Characteristics
- Characteristic 1
- Characteristic 2
- Characteristic 3
- Characteristic n

OEM

Supplier 1
QIF Results & Statistics
- C1
- C2
- C3
- ...
- Cn

Supplier 2
QIF Results & Statistics
- C1
- C2
- C3
- ...
- Cn

Supplier 3
QIF Results & Statistics
- C1
- C2
- C3
- ...
- Cn

Supply Chain
Example Workflow – Supply Chain Control

Technical Data Package
- Native Model
- ...
- Certified QIF MBD
- QIF Plans (BOC)

QIF Plan
Bill of Characteristics
- Characteristic 1
- Characteristic 2
- Characteristic 3
- Characteristic n

QIF Results & Statistics Stream
- QIF Results
- QIF Statistics
- QIF Results
- QIF Statistics

Supplier 1
- QIF Results & Statistics
  - C1
  - C2
  - C3
  - Cn

Supplier 2
- QIF Results & Statistics
  - C1
  - C2
  - C3
  - Cn

Supplier 3
- QIF Results & Statistics
  - C1
  - C2
  - C3
  - Cn

OEM

Supply Chain
Example Workflow – Supply Chain Control

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QIF Results & Statistics
Supplier 1: C1 C2 C3 ...
Supplier 2: C1 C2 C3 ...
Supplier 3: C1 C2 C3 ...

Technical Data Package
• Native Model
• ...
• Certified QIF MBD
• QIF Plans (BOC)

QIF Plan
Bill of Characteristics
Characteristic 1
Characteristic 2
Characteristic 3
Characteristic n

Results & Statistics
Traceable and Organized

QIF Results & Statistics Stream
QIF Results
QIF Statistics
QIF Results
QIF Statistics
QIF Results
QIF Statistics

Supplier 1
QIF Results & Statistics
C1 C2 C3 ...

Supplier 2
QIF Results & Statistics
C1 C2 C3 ...

Supplier 3
QIF Results & Statistics
C1 C2 C3 ...

OEM

Suppliers

Supply Chain
QIF Workflow – IoT & Industry 4.0

1st: Mechanization, water power, steam power
2nd: Mass production, assembly line, electricity
3rd: Computer and automation
4th: Cyber Physical Systems

QIF Model & Meas Plan

QIF Model
Digital Twin Research: The QIF format as a backbone for data transmission and storage in support of the Digital Twin concept
Questions?
Please contact us:

Daniel Campbell
dc@capvidia.com