DMDII 15-11-08:
Capturing Product Behavioral and Contextual Characteristics through a Model-Based Feature Information Network (MFIN)

Project Members:
Project Objective

- Simulation
- Manufacturing
- Measurement
- CAD
- MFIN
- MRO
Project Objective

**MFIN Demonstrator**

1. Run a FE simulation on the model. Simulation should be started with CAD model and materials data from MFIN as inputs. Simulation results should be stored in MFIN.
2. Automatically generate machining process plan from the CAD and PMI data. The process plan is stored in the MFIN.
3. CMM measurement plan is automatically created from the CAD, PMI, and knowledge of available CMM equipment. The CMM measurement plan is stored in the MFIN. CMM program is executed, and measurement results are stored in MFIN.
4. MRO data is received, and the user associates this data with the appropriate feature on the model. This connects the MRO data with the MFIN and authority CAD model.
5. Now that we have run from beginning to end, we navigate and browse all MFIN data from steps 1-4. We show how all of this data is associated with the model, and is also cross-correlated.
15-11 Swimlanes

<table>
<thead>
<tr>
<th>Design</th>
<th>Analysis</th>
<th>Process Planning</th>
<th>Quality Planning</th>
<th>Inspection</th>
<th>MRO &amp; Operation Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design part with semantic PMI, vault in PLM</td>
<td>Extract material specifications, perform analysis</td>
<td>Extract material &amp; process specs, load MBOM, autogen work instructions</td>
<td>Extract GD&amp;T, autogen inspection plan for CMM</td>
<td>Inspect part, return measurement results</td>
<td>Feed as-maintained info back to PLM</td>
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<tr>
<td>Maintain data traceability between meas results and authority CAD</td>
<td>Maintain data traceability between MRO data and authority CAD</td>
<td>Maintain data traceability between MRO data and authority CAD</td>
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MFIN Data Model

- Maintains mapping between Authority Model and downstream data
- Powered by a Feature-Based conceptualization of the model
- Uses QIF as a base, extending as necessary for analysis and process planning
MFIN Data Model

FEA Simulation

Manufacturing Process Plan

Measurement Plan

Measurement Results

MRO Data (Traceable to MBD)

Materials Database

Manufacturing Process System

Measurement Process System

MRO Data Acquisition Process

Specs

Materials Data

Geometry and PMI (read only)

Geometry

Legend

Process/Application/Software

Data

Rolls-Royce

TechAu1

MSC Software

GRANTA

CAPVIDIA

PTC

LOKKE MARVIN

PURDUE UNIVERSITY

DMDII

Model-Based Enterprise Summit 2018
NIST, Gaithersburg, MD, USA
April 2-5, 2018
Analysis Workflow

1. Converting Native CAD file to neutral formats (QIF/STEP)

2. Using MFIN API to assign and link material properties to features in the model

3. Storing the model with links in MFIN Database

4. Consuming the model and building properties from the links for analysis

5. Create MFIN data
   - Analysis Input Model
   - Analysis Results

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MSC NASTRAN
Perform Analysis

Material Definitions & Properties From Granta MI or MSC Material Center

Linked to model features

MSC PATRAN
a) Load Model with material definitions.
   b) Apply Loads, BCs and Meshing
c) Post processing and generate results

Analysis Results mapped back to model in MFIN
Process Planning Workflow

part coding → part family formation → standard plan preparation

Standard process plans & individual process plans

part coding → part family search → process plan retrieval

finished process plan → process plan editing
Measurement Workflow

1. Automatically create measurement plan
   - Using NX CMM and the Pundit simulation, create an optimized measurement plan

2. Execute the plan (measure the part)

3. Create MFIN data
   - Measurement plan
   - Measurement results
Endgame: MBD-based product and process data
Thanks!

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