A TEMPLATE FOR INTEROPERABILITY TESTING

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CAx Implementor Forum (CAx-IF)

- Joint testing forum hosted by PDES, Inc., prostep ivip, and AFNeT
- Composed of CAD and CAE vendors as well as translation and validation software developers providing STEP translators
- Closed group (sandbox) allowing implementors to develop and test new approaches in a trusted environment
- Launched in 1999, by merging previous PDES, Inc. and prostep ivip efforts. Since then, 40 test rounds have been completed focused on CAD domain. CAE domain test rounds started in September, 2017
- Mission is to meet industry’s needs by developing and testing standards based interoperable products
How Industry benefits from the CAx-IF

**Member / Vendor Benefits**

- Testing in a closed, trusted environment
- Early detection of errors leads to faster development cycles
- Beta-testing with other systems enhances product interoperability and robustness even before production release
- User requirements can be communicated, and common implementation approaches agreed upon

**User / Customer Benefits**

- Stability of new capabilities
  - E.g. PMI Polyline Presentation: Since testing started in 2008, no major changes to implementation structure. Widely used in industry now!
- Early feedback on requirements
  - Concerning feasibility, and timeframe for support in various tools
CAx Implementor Forum “on a page”

- CAx Implementor Forum
- CAx User Companies
- Requirements
- Issues
- Test Models
- Standardization Issues
- ISO 10303 Standardization Working Groups
- Result Summaries
- Improved STEP Processors
- Interaction with other project groups
- ProSTEP iViP and PDES, Inc. Working Groups
- New and updated STEP Parts
- Recommended Practices
- Improved Data Exchange Quality
- Interoperability
- Widened STEP Scope

November 2017 CAx-IF Overview
ISO 10303 standard
STEP AP 242
for
Managed Model Based
3D Engineering
For the aerospace, automotive, & other mechanical manufacturers and their suppliers

http://www.ap242.org/
AP242 Implementation History

<table>
<thead>
<tr>
<th>IS Version (v1.36)</th>
<th>Pre-IS Version (v1.33)</th>
<th>DIS Version (v1.23)</th>
<th>CD Version</th>
</tr>
</thead>
<tbody>
<tr>
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**1st Point Release**

<table>
<thead>
<tr>
<th>Test Round</th>
<th>Year</th>
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<tbody>
<tr>
<td>28J</td>
<td>2011</td>
</tr>
<tr>
<td>29J</td>
<td>2012</td>
</tr>
<tr>
<td>30J</td>
<td>2013</td>
</tr>
<tr>
<td>31J</td>
<td>2014</td>
</tr>
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</table>

**2nd Point Release**

<table>
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<th>Test Round</th>
<th>Year</th>
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</thead>
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<td>2011</td>
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<tr>
<td>28J</td>
<td>2012</td>
</tr>
<tr>
<td>29J</td>
<td>2013</td>
</tr>
<tr>
<td>30J</td>
<td>2014</td>
</tr>
</tbody>
</table>

Earliest support of AP242 in commercial products
CAx-IF Testing Methodology

1. Participants provide STEP files based on:
   - Current EXPRESS / XML Schemas
   - Latest (draft) Recommended Practices
   - Test Case definitions

2. STEP files are checked for:
   - Syntax (conformance to schema)
   - Structure / Semantics (conformance to Recommended Practices)

3. STEP files and corresponding statistics are provided in the member area of the CAx-IF homepage

4. Participants grab all provided files, process them, and report on their results. Detailed review at meeting.

5. If issues are found, they are resolved during the test round as far as possible.
Recommended Practices Documents

Recommended Practices for AP242 Business Object Model XML Assembly Structure
Release 1.00
February 13, 2015

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Recommended Practices for Geometric and Assembly Validation Properties
Release 4.2
October 2, 2014

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Recommended Practices for External (Element) References
Release 3.1
January 20, 2014

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CAx-IF Test Case Specification

Test Suite for the CAx Implementor Forum
Round 31J
October 2012 – March 2013
Release 1.0

December 19, 2012

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2.5.3.2 Test Model “16792”

Another test model testing PMI representation capabilities is taken from ISO 16792. The model is provided in the member area of the CAxIF homepage, under “Information on RoundJ of Testing”, as ZIP file containing:
- A STEP file containing the geometry “screw” for recreation in other CAD systems
- A PDF document extracted from ISO 16792 providing the detailed description of the PMI to be added.

2.5.3.3 Test Model Configuration

The following additional functionality should be included in the test file provided for this round of testing, as far as it has been implemented by the CAx-IF participants and is described in the Recommended Practices:
- PMI Data Structure – the required representation of PMI data should be included in all STEP models to be tested supported by the native system.
- PMI Graphic Presentation – Many CAD systems require some minimal presentation information to be able to handle the PMI data in a model. There are also use cases where both PMI representation and presentation data will be included in the same file. Thus, some form of presentation information shall be included in the STEP test cases as well. The test model configuration for the presentation part is similar to the RTJ test case, see section 2.1.3.5.

Linking PMI Data to Representation – if a model contains PMI representation information as well as presentation data, it is very useful to link the corresponding information.

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http://www.caix.org

CAX Implementor Forum
Round 31J Test Suite
November 19, 2012

2.4.3.2 Statistics

For each STEP file supported or imported for the CAx test cases, vendors must submit the corresponding statistics. To do so, go to the (C) Data Sheet, and either fill in the web form, or append a comma-separated file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or “not supported”. For other statistics, select “full support” (i.e. test case and Rev, Prop, definitions are fulfilled), “limited support” (assuming the implementation does not meet all criteria and issues may be expected on export), or “not supported”.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mode</td>
<td>The name of the test model, e.g., “CT”</td>
</tr>
<tr>
<td>system</td>
<td>The system code of the CAD system creating the STEP file</td>
</tr>
<tr>
<td>system_s</td>
<td>The system code of the CAD system importing the STEP file. For native data, enter “step”</td>
</tr>
<tr>
<td>unit</td>
<td>The unit the model is designed in</td>
</tr>
<tr>
<td>volume</td>
<td>Total volume of all solids</td>
</tr>
<tr>
<td>validation_volume</td>
<td>Total volume of all solids as received via the validation process capability</td>
</tr>
<tr>
<td>area</td>
<td>Total surface area of all solids</td>
</tr>
<tr>
<td>validation_area</td>
<td>Total surface area of all solids (entire assembly, as received via the validation process capability)</td>
</tr>
<tr>
<td>facet_area</td>
<td>Area of all facets</td>
</tr>
<tr>
<td>surface</td>
<td>Total length of all independent curves in the model</td>
</tr>
</tbody>
</table>

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CAx Implementor Forum
Round 31J Test Suite
November 19, 2012

November 2017

CAx-IF Overview

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CAx-IF Online Test Environment

[Image of test environment screen shots]
Activities supporting and promoting STEP AP242 implementation

• NIST MBE PMI Validation and Conformance Testing
  • Developed set of publicly available test cases for PMI
  • Natively modeled in four major CAD systems
  • Reviewed by expert users and system vendors
  • Used by CAx-IF and AP242 Benchmark as reference point
    ► https://go.usa.gov/mGVm

• NIST STEP File Analyzer
  • Creates spread sheets from STEP files
  • Generates report for AP242 PMI Representation and Presentation
  • Lists Validation Properties
  • Verifies compliance with Recommended Practices
    ► https://go.usa.gov/yccx
Activities supporting and promoting STEP AP242 implementation

- PDES, Inc. / prostep ivip “CAx Implementor Forum”
  - Creation of Recommended Practices for STEP (Part 21 and XML)
  - Joint test rounds, focus on geometry and assembly structure
  - Closed group / development environment

- Prostep ivip / VDA “JT Implementor Forum”
  - Creation of Implementation Guidelines for JT
  - Joint Test Rounds, focus on geometry and assembly structure
    - including combined use of AP242 XML and JT
  - Closed group / development environment

- AFNeT / prostep ivip “PDM Implementor Forum”
  - Creation of Recommended Practices for STEP (XML)
  - Joint test rounds, focus on PDM-relevant information
  - Closed group / development environment
For more information about the CAx-IF:

https://www.cax-if.org/

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