Geometry & Kinematics

<AutomationML/>

The Glue for Seamless Automation Engineering
Overview about AutomationML

AutomationML
Engineering data

CAEX IEC 62424
Top level format

Plant topology information
- Plants
- Cells
- Components
- Attributes
- Interfaces
- Relations
- References

Object A
  ↘
  Object A₁
  ↘
  Object A₂
  ↘
  ...
  ↘
  Object Aₙ

COLLADA
Geometry
Kinematics

PLCopen XML
Behaviour
Sequencing

Further XML Standard format
Further aspects of engineering information
AutomationML incorporates COLLADA for geometry and kinematics information

- COLLADA is an industry standard (Khronos Org.)
- COLLADA is XML based
- COLLADA is seamless integrated in AutomationML
A short history of COLLADA

- **Started in 2003 SIGGRAPH San Diego**
  - Focus on 3D content
  - Mesh geometries
  - Branches: gaming (Sony, Intel, Autodesk, NVidia, ...)

- **2007 AutomationML joins Khronos**
  - Proposals for BREP and Kinematics
  - Branches: gaming, GIS (Google Earth), automation industry (ABB, Daimler, ...)

- **2008 COLLADA 1.5.0**
  - With BREP and Kinematics, MathML
  - Official commitment by Bentley (MicroStation)
  - Official commitment by Siemens
COLLADA covers information for interchange of 3D geometry

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
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</thead>
</table>
| ![Part geometries](image1) | • Part geometries  
  • Exact description as BREP  
  • Display description as meshes |
| ![Definition of materials](image2) | • Definition of materials  
  • Simple shaders (specular color, diffuse color, …)  
  • Complex shaders (GLES, …)  
  • Textures (Bitmap, GIF, …) |
| ![Definition of product structure](image3) | • Definition of product structure  
  • Instanciation of parts and subassemblies  
  • Binding materials to parts  
  • Level of Detail |
Collada enables interchange of kinematic descriptions

<table>
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</table>
| ![Image](example1.png) | ▪ **Definition of kinematic models**  
  ▪ Description of joints  
  ▪ Description of links  
  ▪ Description of constraints (limits, closed loops, formulas) |
| ![Image](example2.png) | ▪ **Definition of articulated systems**  
  ▪ Kinematic constraints (locked joints, active joints,…)  
  ▪ Dynamic constraints (velocity, acceleration,…)  
  ▪ Kinematic frames |
| ![Image](example3.png) | ▪ **Definition of kinematic scenes**  
  ▪ Assembly of kinematic systems  
  ▪ Parametrization of kinematic systems  
  ▪ Binding of kinematics to geometry |
Closing the gaps between different tools and models

Transformation to AutomationML
Cell HC15 in DELMIA V5
Cell HC15 in PDF
Cell HC15 in COLLADA Viewer
Cell HC15 in VGR
Cell HC15 in JT2Go
Cell HC15 in Robcad
Cell HC15 in Sketchup
Summary AutomationML
geometry and kinematics

- Covers 3D geometry and kinematics

- Enhanced with features for industry: BREP, Kinematic

- Based on COLLADA

- Already used in planning workflows: Daimler, Schulz Engineering, BMW, …
Join AutomationML!

http://www.automationml.org