Lost in Translation
Technological Views on Preserving CAD

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15 August 2014
Outline

Introduction

3D geometric representations

Advanced modelling techniques

Use cases

Possible solutions
Introduction
The main technological barrier to preserving CAD is variety

- of 3D geometric representations
- of advanced modelling techniques
- of use cases
3D geometric representations
Wire-frame modelling
Wire-frame modelling
Surface modelling

- Extruding
- Sweeping
- Lofting
- Revolving
- Triangular mesh
- NURBS
Constructive Solid Geometry
Boundary representation
Mistranslation and misinterpretation

Cracks after healing algorithm fails to reconstruct a valid boundary representation.

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There are many incompatible ways of modelling 3D geometry.

There are many incompatible ways of interpreting 3D models.
Advanced modelling techniques
Construction history modelling

1. Insert cylinder \( l = 20 \) \( r = 1.0 \)

\[ \text{Change cylinder } l = 40 \text{ } r = 0.5 \]

2. Insert sprocket \( r = 3.0 \)

3. Fit sprocket to cylinder

4. Group cylinder and sprocket

5. Scale group by \( 1.75 \times \)

\[ \ldots \]
Procedural modelling

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Parametric modelling
Feature-based modelling

- Ribs
- Cavities
Advanced modelling techniques

- CAD models contain much more than just geometry.
- The geometry might be useless without the extra information.
Use cases
Reusing standard parts

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[Diagram of a top-level assembly and its subassemblies, showing parts and subassemblies labeled with letters a through j.]
Relationship with other documents

- Bill of Materials
- Archaeology Database
- Process Model
- Rationale Model
- Systems Models
- CAD Model
- ...
Integration with other systems

- CAD System
- CAM System
- Finite Element Analysis System
- Geographic Information System
- Animation System
- High Quality Renderer

...
Use cases

- You might need to coordinate CAD models with many other types of information.
- You might need to mimic whole systems.
Possible solutions
Standards: IGES

IGES
(ANSI Y14.26M-1981, …
ANS US/PRO/IPO-100-1996)

- 2D drawing
- Wire-frames
- Surface modelling
- Constructive solid geometry
- Boundary representation
Standards: IGES

IGES
(ANSI Y14.26M-1981, …
ANS US/PRO/IPO-100-1996)

2D drawing
Wire-frames
Surface modelling
Constructive solid geometry
Boundary representation

Wunder CAD

CAD-ulous
Standards: STEP

STEP
ISO 10303

LOTAR
(NAS 9300/EN 9300)
Standards for BIM, CAD style conventions

BIM

- ISO 16739:2013 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries
- National BIM Standard – United States (NBIMS-US)
- AEC (UK) BIM Protocol
- (BSI) PAS 1192-2 Information management for the capital/delivery phase of construction projects

CAD style

- United States National CAD Standard
- AEC (UK) CAD Standards For Layer Naming
Recommendations

- Establish why a CAD model will be kept, then target the required properties for preservation.
- Create tests that can prove whether these properties have survived.
- Keep native CAD models for as long as they can be read.
- Normalise to STEP/IFC and a geometry-only standard (or two).
- Don’t forget supporting documentation, especially local conventions and ‘house style’.
- Campaign for better support for standard formats in CAD systems!
Preserving Computer-Aided Design (CAD)

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http://dx.doi.org/10.7207/twr13-02

DPC Technology Watch Report 13-02 April 2013
Thank you for your attention

DCC Website: http://www.dcc.ac.uk/

‘Preserving CAD’ report:
http://dx.doi.org/10.7207/twr13-02