Feature-based Modelling and Information Systems in Engineering

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Sept. 25, 2015

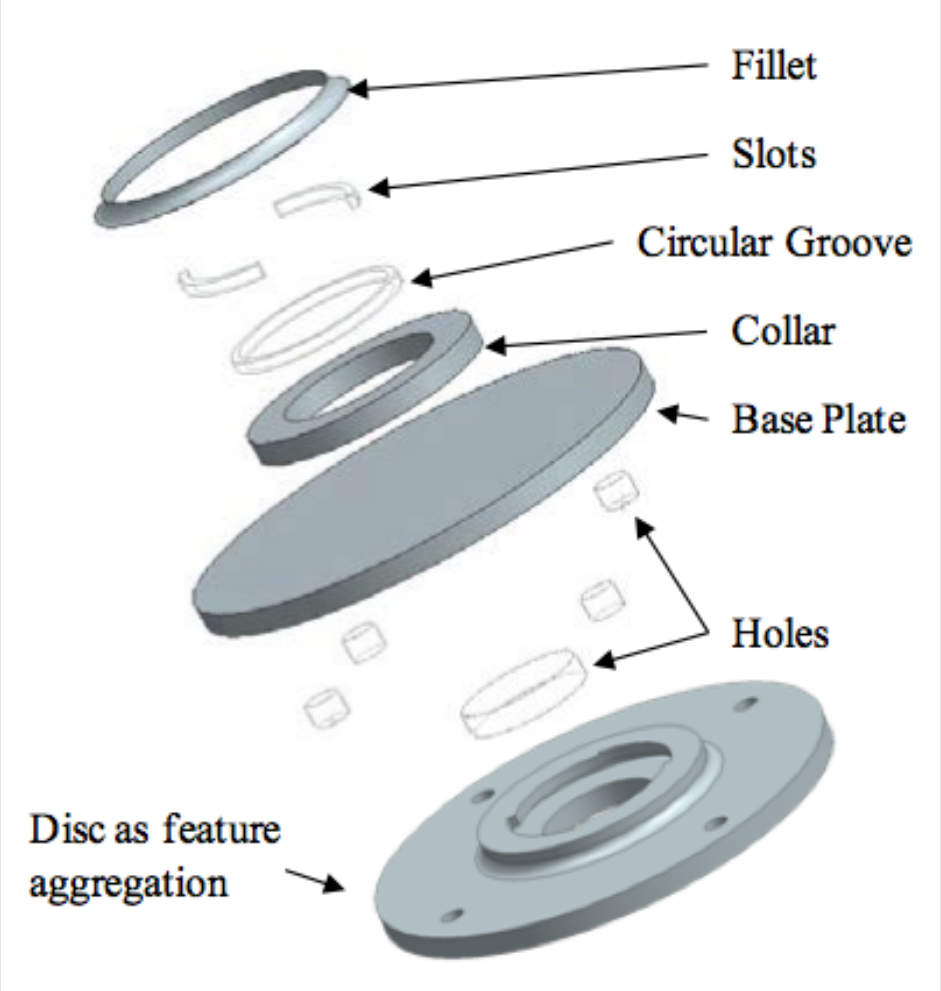
14th Conference of the Italian Association for Artificial Intelligence

Product lifecycle knowledge management

Product lifecycle knowledge management (PLM):

- Need of clear understanding of domain knowledge ;
  - What is a product? What are its features?
- Need of formal knowledge representations;
  - Data standards vs ontologies
- Need of knowledge-based systems for data modelling, data integration and data sharing;
  - Multiple-views integration (design vs manufacturing).
  - Concurrent design systems

The feature-based approach to PLM



The feature-based approach to PLM

Table 1: Design and manufacturing features

Design features			*Manufacturing features*		
Base Features	**Stress Relieving Features**	**Joining Features**	**Turning Features**	**Milling Features**	**Drilling Features**
1. Base plate 2. Collar	1. Fillet	1. Holes 2. Seal loading slots 3. Circular groove	1.Circular groove 2. Base Disc 3. Collar 4. Fillet	1. Seal loading slots	1. Holes

Drawbacks of current approaches

No principled methodology for features' conceptualisation and formal specification.

Result,

- No clear understanding of feature notions;
- Disconnected approaches and data models for feature-based product modelling;
- Often features are only macro-modelling elements;
  - No qualitative machine-processable knowledge attached.

Ontology-based features modelling for PLM

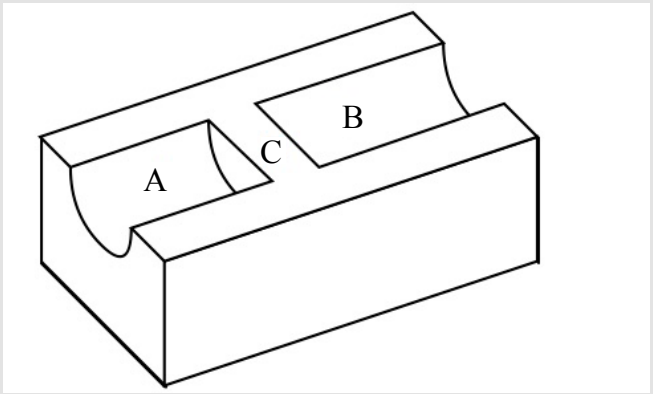
What we propose:

- Ontological classification of feature notions based on foundational ontology, namely DOLCE
  - Stable and well-founded conceptual framework;
    - Distinguish basic notions, e.g. shape vs boundary vs attribute;
  - Upper-level umbrella for multiple domain- and application-ontologies specialisation and integration
- Formal theory for feature representation
- Methodology for heterogeneous knowledge integration (design vs manufacturing, shape vs machining tools)

And,

- F1-feature: modelling element;
- F2-feature: physical feature.

Ontology-based features modelling for PLM



f1 $FC_{Fr}(f) \wedge CH(cob, f, t) \wedge CF(f, t, pf, t') \wedge$
$CF(f_s, t, pf_1, t') \wedge CF(f_s, t, pf_2, t') \wedge$
$CF(f_r, t, pf_3, t') \wedge pf = pf_1 + pf_2 + pf_3$

f2 $FC_{Ft}(f) \wedge C_{Ft}(cft) \wedge CH(f, cft, t)$

f3 $FC_{Mt}(f) \wedge C_{Mt}(cmt) \wedge CH(f, cmt, t)$

f4 $FC_{Mf}(f) \wedge C_{Mf}(cmf) \wedge CH(f, cmf, t)$