Conformance Class Exploration

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Definition

In CIS/2 documentation a conformance class is defined as ‘a valid subset of the LMP/5 EXPRESS schema, ‘ and the primary purpose is ‘to test a particular CIS implementation for conformance to CIS/2 standard.’

Structure and generation method

“A Conformance Class is specified as a short form EXPRESS schema using STEP schema interfacing. The Conformance Class schemas contains no entity or type declarations, merely the USE FROM and the REFERENCE FROM declarations.”

One way of examining the structure of Conformance Class is to flatten it and create a long form schema. We could see the actually entities and scope of it. Let’s take CC164 Analysis model as an example. The valid entities are bold.

```
(* CIS/2 Conformance Class 164 *)
SCHEMA LPM5_CC164;

USE FROM STRUCTURAL_FRAME_SCHEMA (analysis_model);
--Base Entity


ENTITY analysis_model
SUPERTYPE OF (ONEOF
            (analysis_model_2D,
            analysis_model_3D) ANDOR
            analysis_model_located ANDOR
            analysis_model_child);
      model_name : label;
      model_description : OPTIONAL text;
      model_type : frame_type;
      method_of_analysis : OPTIONAL analysis_method;
      coordinate_space_dimension : dimension_count;
INVERSE
      component_elements : SET [1:?] OF element
            FOR parent_model;
      component_nodes : SET [2:?] OF node
            FOR parent_model;
END_ENTITY;

REFERENCE FROM LPM5_CC003;  -- cartesian_point
--
SCHEMA LPM5_CC003;  -- cartesian_point

ENTITY cartesian_point

SUBTYPE OF (point);
      coordinates : LIST [1:3] OF length_measure;
```

#include from schema

Extern from other CCs for Function operations

```
END_ENTITY;  --  STEP Part 42


REFERENCE FROM STRUCTURAL_FRAME_SCHEMA ( -- Entites
dimensional_exponents,
geometric_representation_context,
geometric_representation_item,
global_unit_assigned_context,
length_unit,
named_unit,
point,
representation,
representation_context,
representation_item);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA ( -- Types
dimension_count,
identifier,
label,
length_measure,
measure_value,
text,
unit);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA (  -- Functions
bag_to_set,
derive_dimensional_exponents,
dimension_of,
using_representations,
valid_units);

END_SCHEMA;


REFERENCE FROM LPM5_CC002;  -- length_measure_with_unit
--
SCHEMA LPM5_CC002;  -- length_measure_with_unit
ENTITY length_measure_with_unit
SUBTYPE OF (measure_with_unit);
WHERE
      WRL38 : 'STRUCTURAL_FRAME_SCHEMA.LENGTH_UNIT' IN
            TYPEOF (SELF\measure_with_unit.unit_component);
      WRL39 : 'STRUCTURAL_FRAME_SCHEMA.LENGTH_MEASURE' IN
            TYPEOF (SELF\measure_with_unit.value_component);
END_ENTITY;  --  STEP Part 41

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA ( -- Entites
derived_unit,
derived_unit_element,
dimensional_exponents,
length_unit,
measure_with_unit,
named_unit);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA ( -- Types
length_measure,
measure_value,
```

```
unit);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA (  -- Functions
derive_dimensional_exponents,
valid_units);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA (  -- Entities
analysis_method,
boundary_condition,
boundary_condition_logical,
element,
element_eccentricity,
element_node_connectivity,
node,
release,
release_logical);

REFERENCE FROM STRUCTURAL_FRAME_SCHEMA (  -- Types
dimension_count,
frame_type,
label,
text);

END_SCHEMA;
```

The method of generating Conformance Class is to pick the base entity first and pull other entities through relationships. Relationships are:

1) Owned attributes of the base entity having other entities as their data type.
2) Attributes inherited from the base entity's supertype(s)
3) Inverse attributes
4) Attributes that involve entities through select data type.
5) Extended supertype relationship: A Conformance Class also includes all the supertype(s) of the base entity and the supertype(s) of the referenced entities.
6) Subtype of an ABSTRACT supertype the subtypes are included.

Each Conformance Class is generated based on those rules starting from the base entity arbitrarily set up.

We could illustrates the scope of each Conformance Class by EXPRESS-G Diagram, which also enables us to examine the relationship between Conformance Classes in a cluster in entity level.

For example, diagram 1 shows CC164 Analysis_model, CC165 Analysis_model_2d, CC166 Analysis_model_3d, CC167 Analysis_model_located, and CC168 Analysis_model_child.

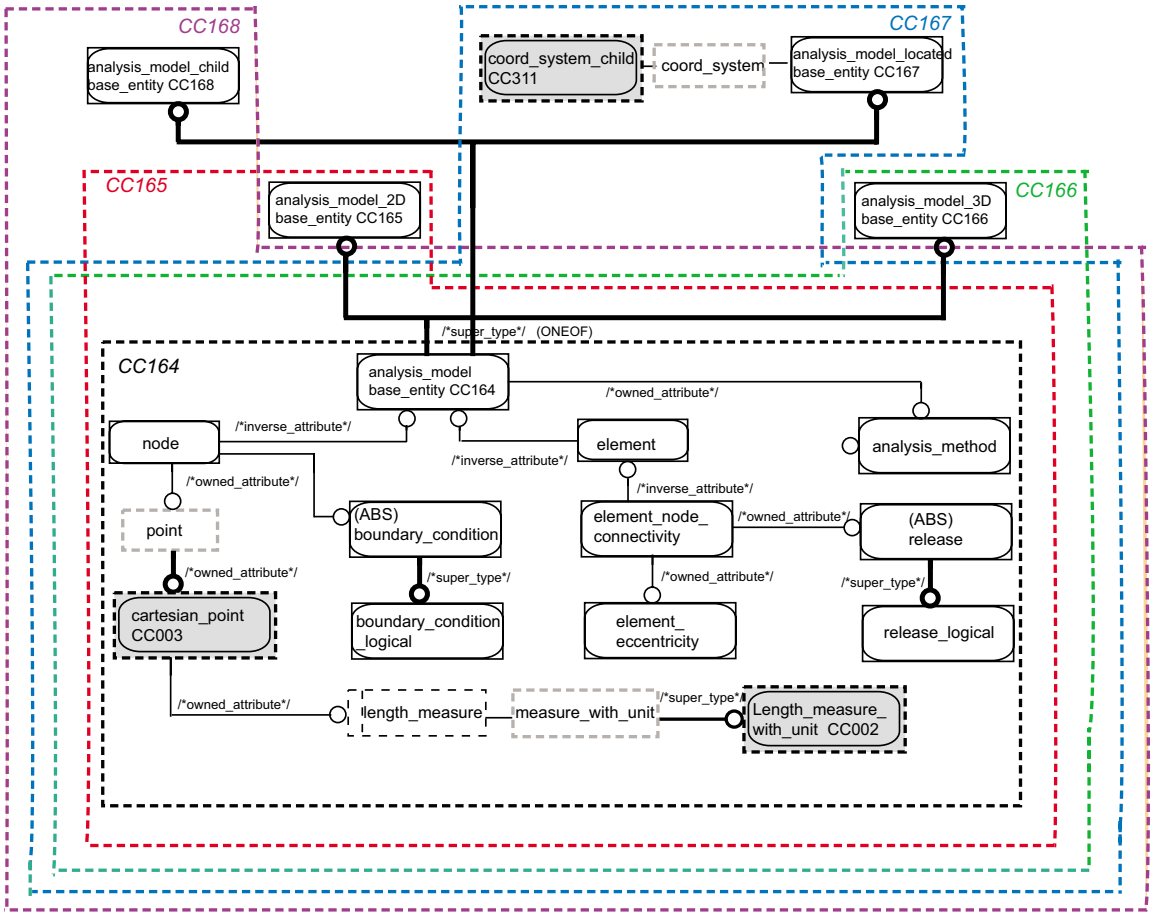


Figure One

Relation Maps of Conformance Classes

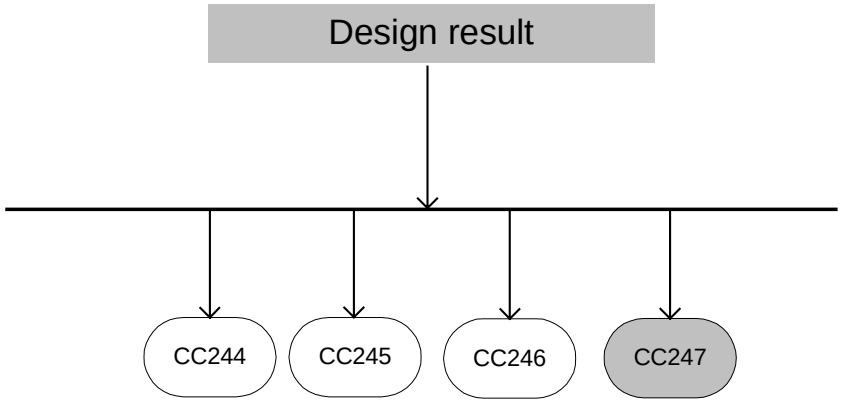
Although individual CC is complete by the rules. The combinations of CCs are more meaningful in practice. We mapped all the Data Management CCs (Numbered CC100 &101) and Specific CCs (Numbered CC102 onwards). Generic CCs and utility CCs are ignored.

Guideline for Use of the Conformance Class Maps

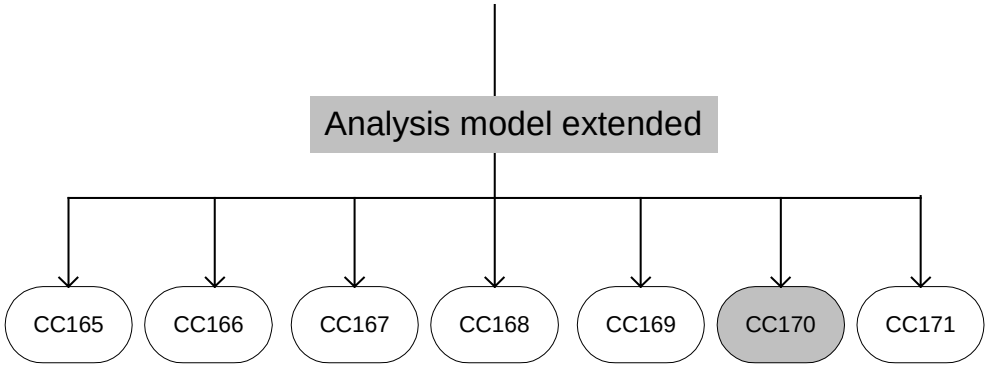
The purpose of the Conformance Class mapping is to help translator developers identify Conformance Classes closely related to a specific topic. This topic itself could be a Conformance Class's base entity. For example, CC164 Analysis_model is the root for a big tree structure. The topic has eight subtopics: Analysis model extended, Element mapping, Element surface, Element volume, Element curve, Release, and Boundary condition. We define this as a tree structure because all the Conformance classes of subtopics reference the base entity of CC164 as a root in combination with other CCs or entities for their specific topic. This is illustrated in Diagram1.

Let's take test model DD504+ from Design Data on CIS/2 Georgia Tech website (http://usa.arch.gatech.edu/aisc/). The basic CCs are CC247 (design_result_member, CC170(assembly_map), CC106 & CC107& CC108(assembly structural design connections and frame). All the other CCs are facilities referenced by those basic CCs.

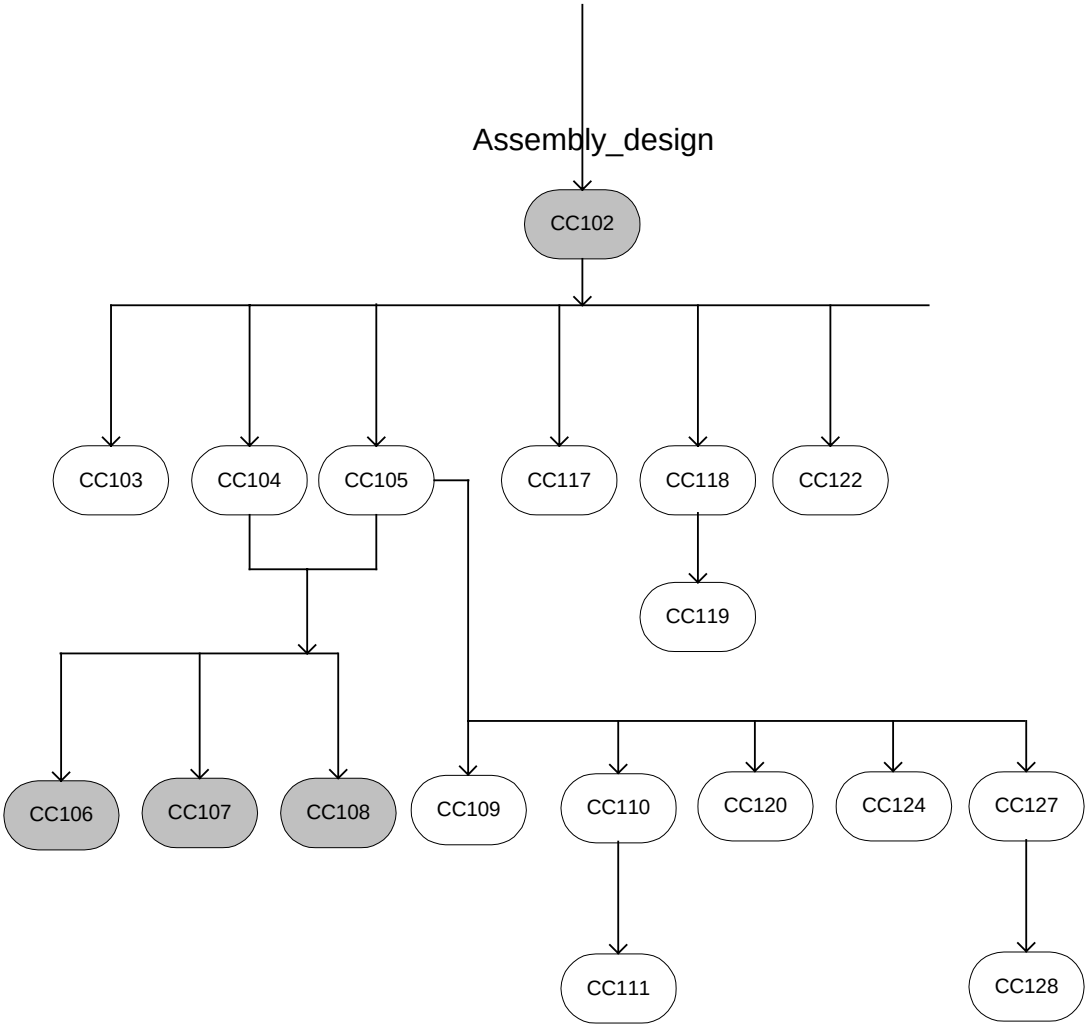
In the map the first basic CC of this model CC247 is list under the topic **Design result**, which includes CC244 (design_result_part), CC245 (design_result_joint_system), CC246 (design_result_connection), and CC247 (design_result_member).

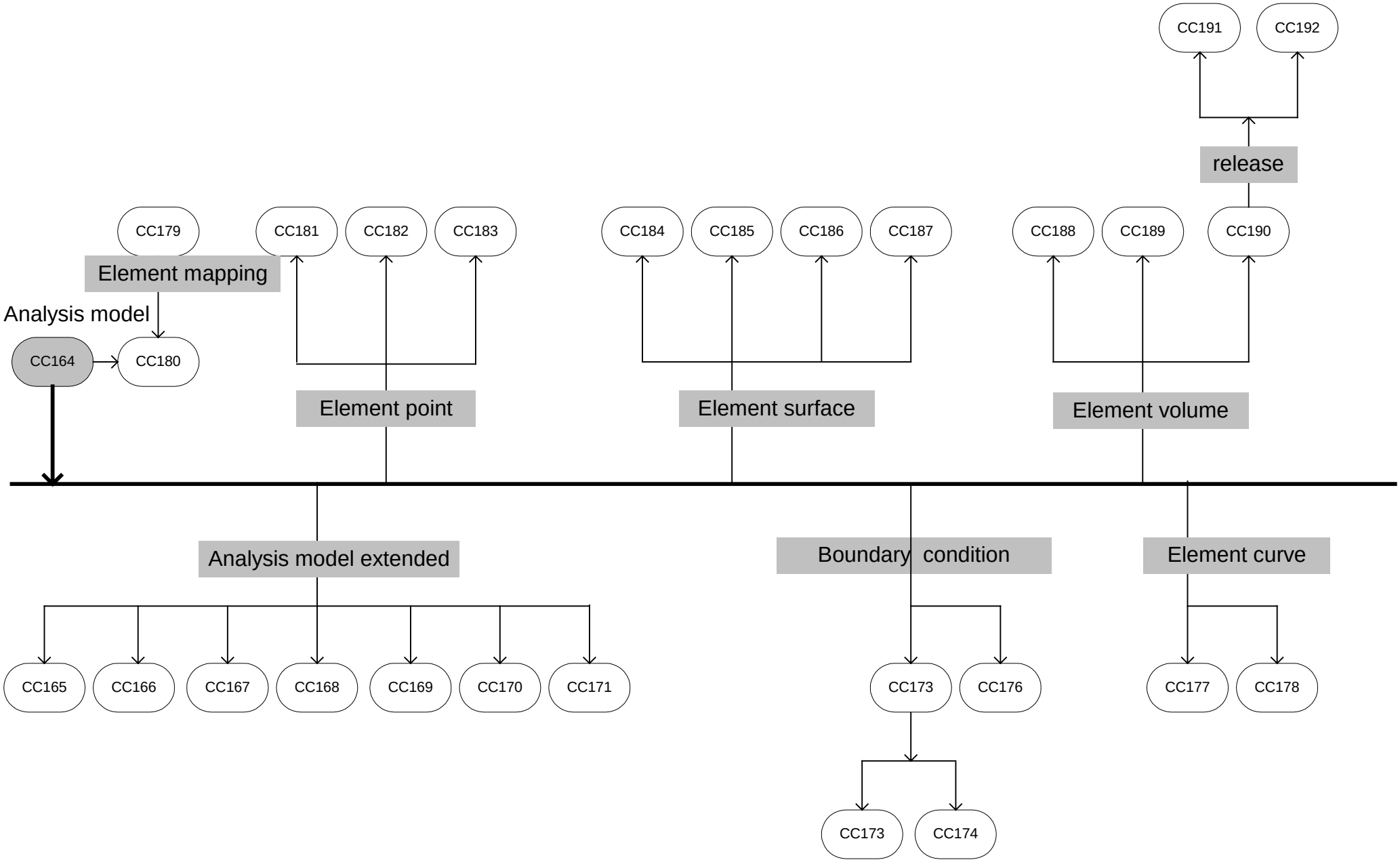


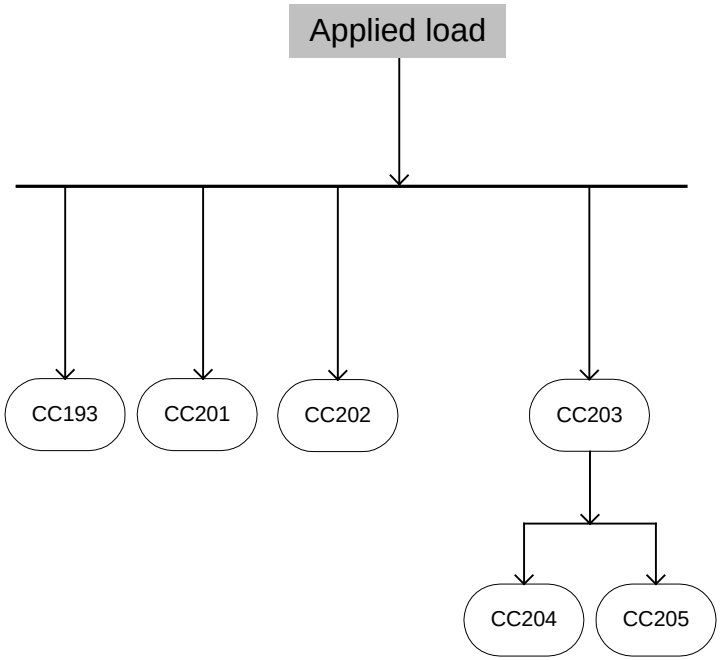
CC170 is listed under Analysis model extended and all sibling CCs— CC165, CC166, CC167, CC168, CC169, CC171—should be considered when translators using CC170 are developed.

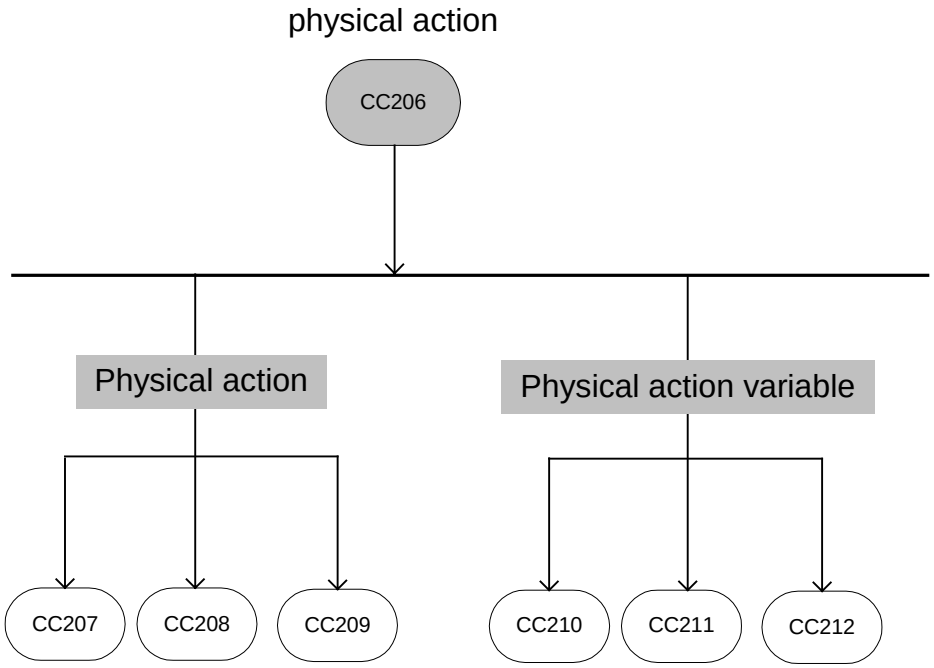


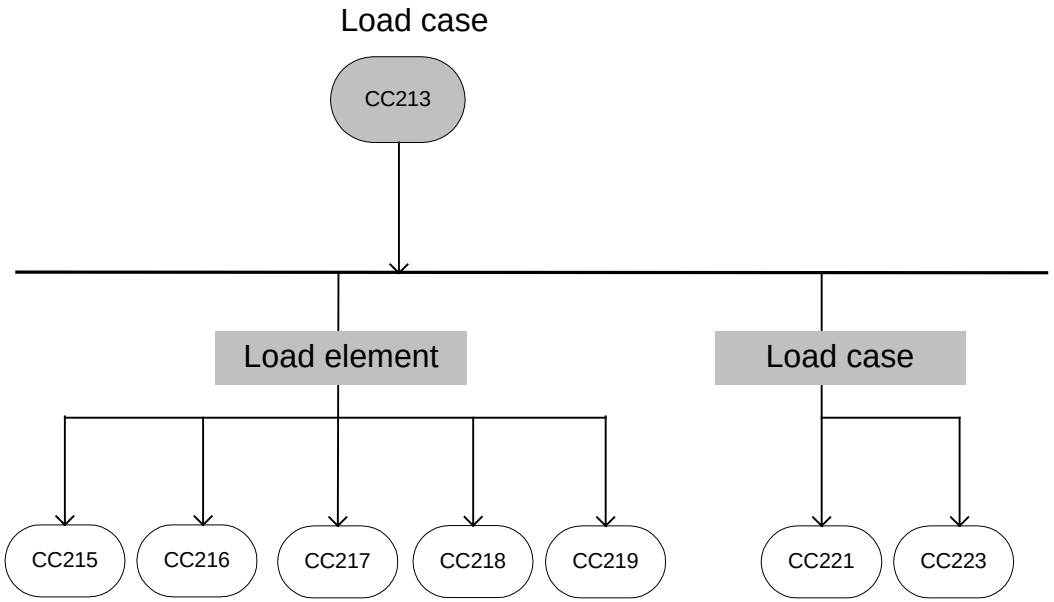
The third one is a very good example. CC106 & CC107& CC108 (assembly structural design connections and frame) are united together, and this combination is clearly illustrated in the map. The other CCs in this tree are candidates for extension of use in translator mappings.

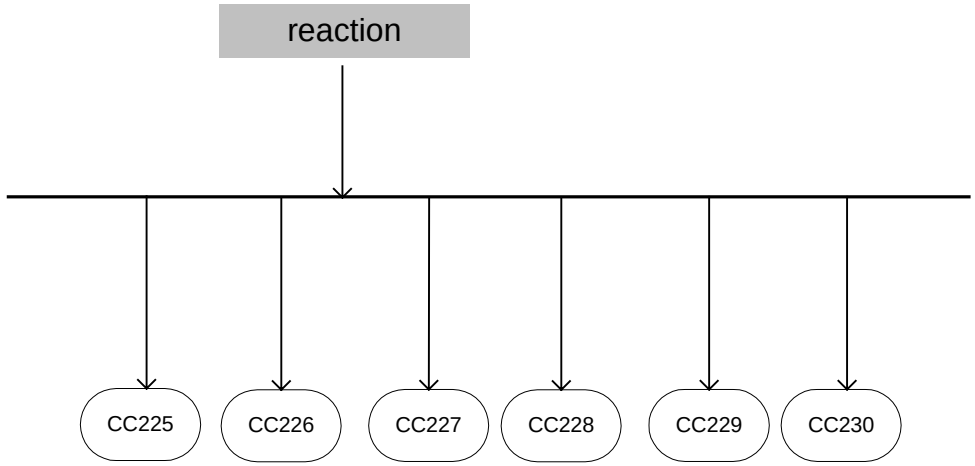

Assembly_design
CC102
CC103
CC104
CC105
CC117
CC118
CC122
CC119
CC106
CC107
CC108
CC109
CC110
CC120
CC124
CC127
CC111
CC128

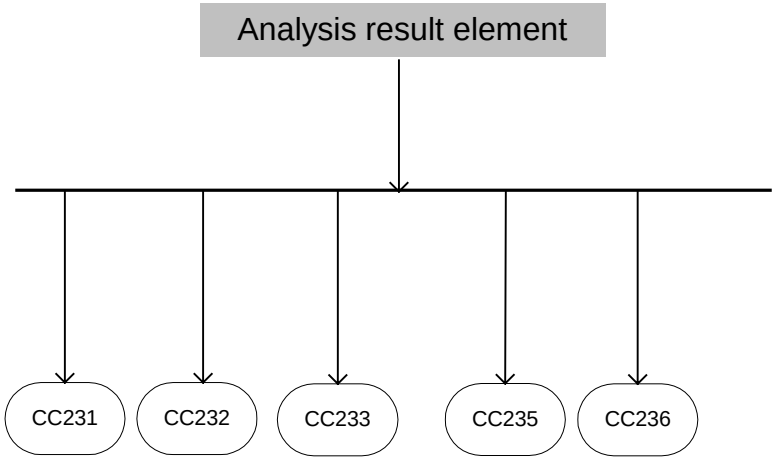

CC191
CC192
release
CC179
CC181
CC182
CC183
CC184
CC185
CC186
CC187
CC188
CC189
CC190
Element mapping
Analysis model
CC164
CC180
Element point
Element surface
Element volume
Analysis model extended
Boundary condition
Element curve
CC165
CC166
CC167
CC168
CC169
CC170
CC171
CC173
CC176
CC177
CC178
CC173
CC174

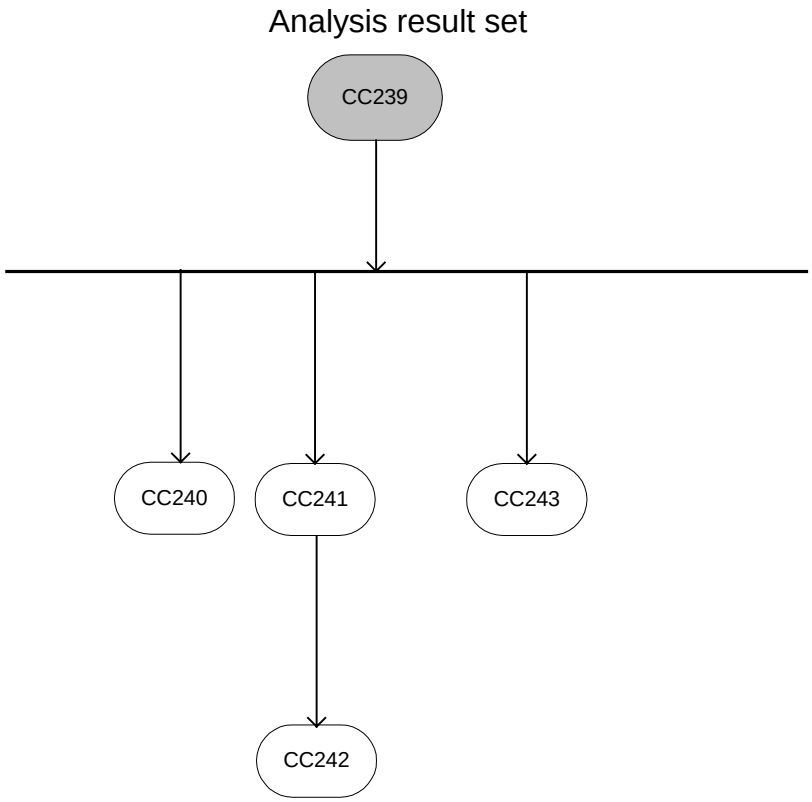

Applied load
CC193
CC201
CC202
CC203
CC204
CC205

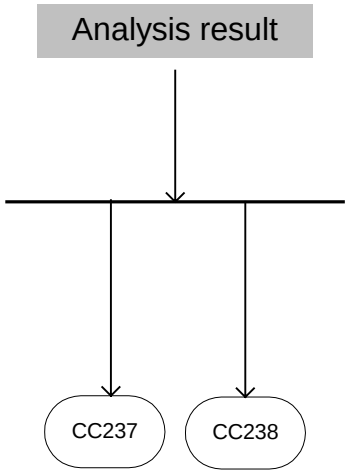

physical action
CC206
Physical action
Physical action variable
CC207
CC208
CC209
CC210
CC211
CC212

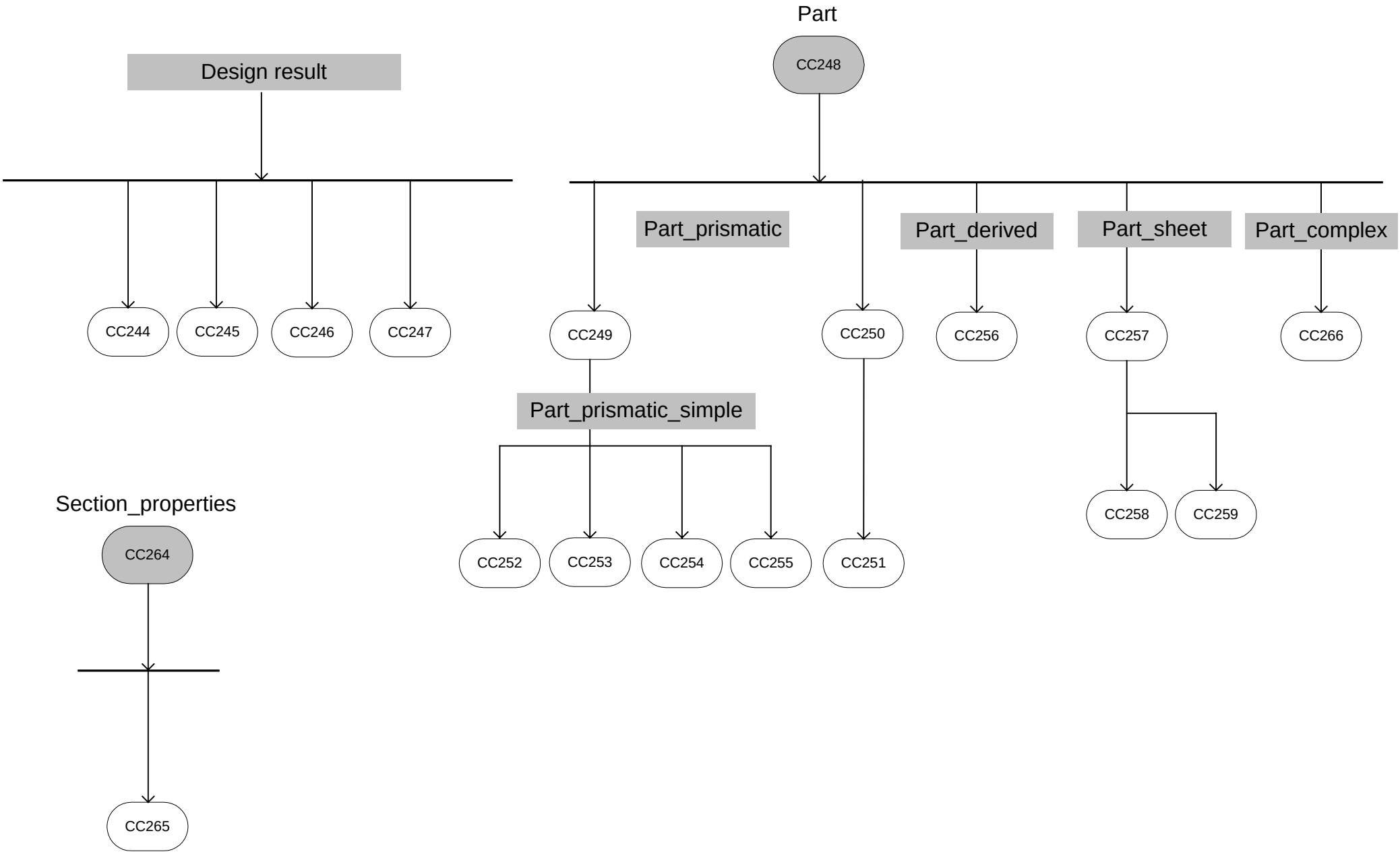

Load case
CC213
Load element
Load case
CC215
CC216
CC217
CC218
CC219
CC221
CC223

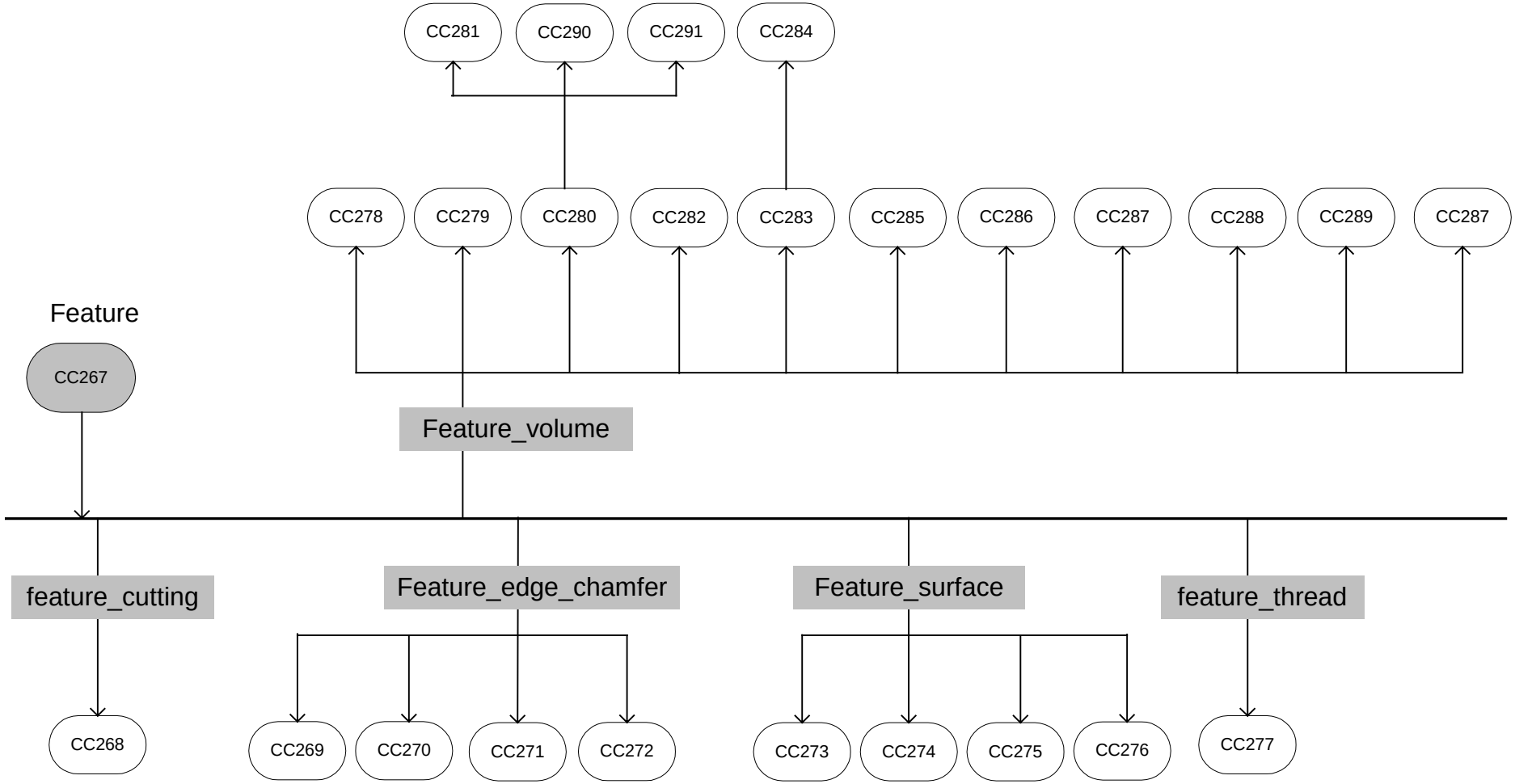

reaction
CC225
CC226
CC227
CC228
CC229
CC230

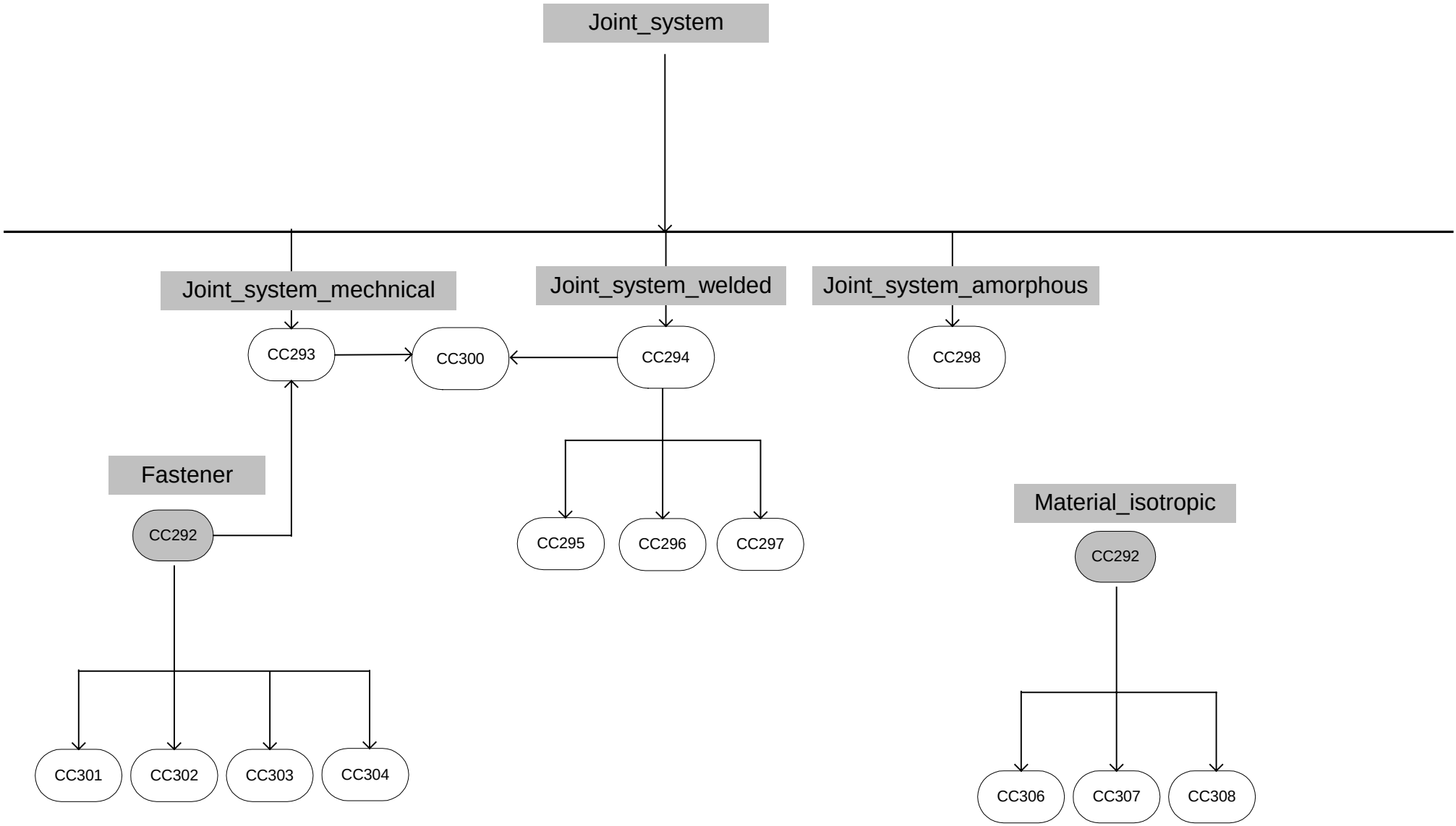

Analysis result element
CC231
CC232
CC233
CC235
CC236

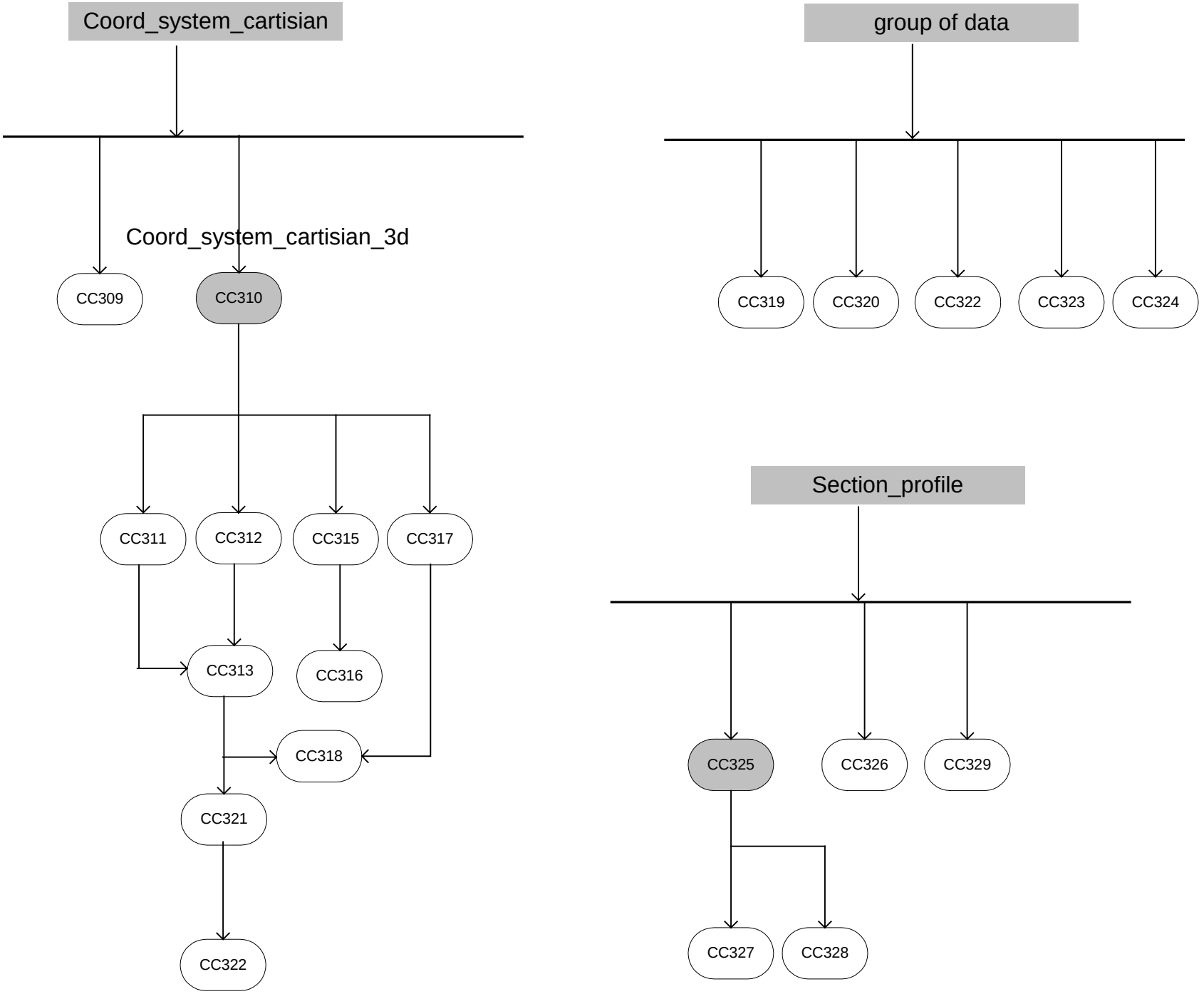

Analysis result set
CC239
CC240
CC241
CC243
CC242

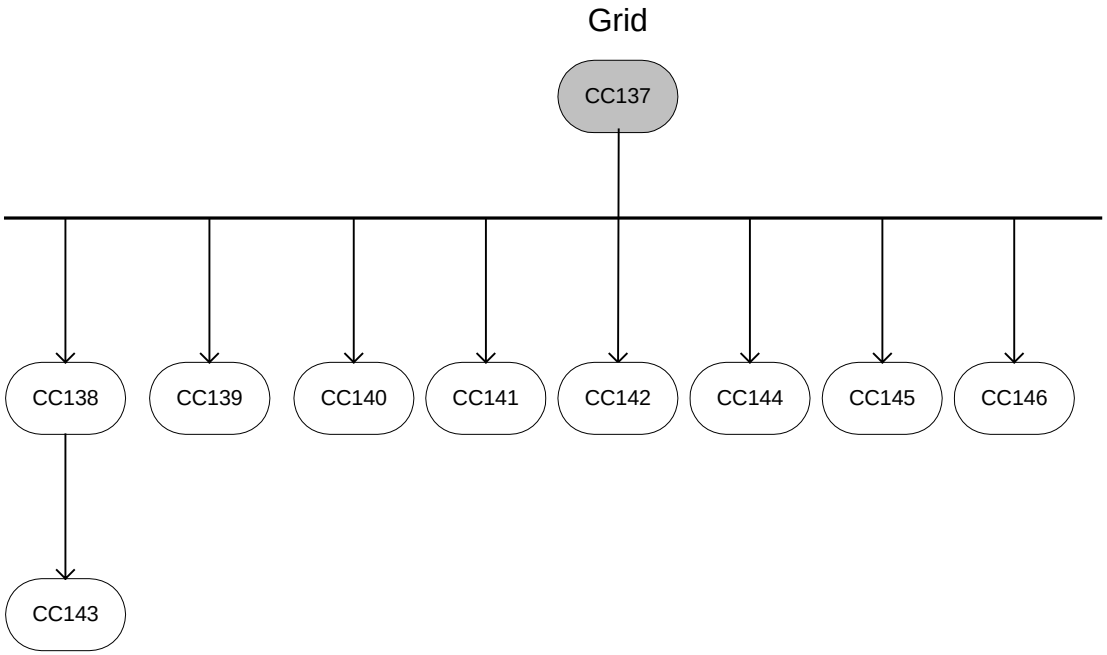

Analysis result
CC237
CC238


Part
CC248
Design result
CC244
CC245
CC246
CC247
Part_prismatic
Part_derived
Part_sheet
Part_complex
CC249
CC250
CC256
CC257
CC266
Part_prismatic_simple
CC258
CC259
CC252
CC253
CC254
CC255
CC251
Section_properties
CC264
CC265

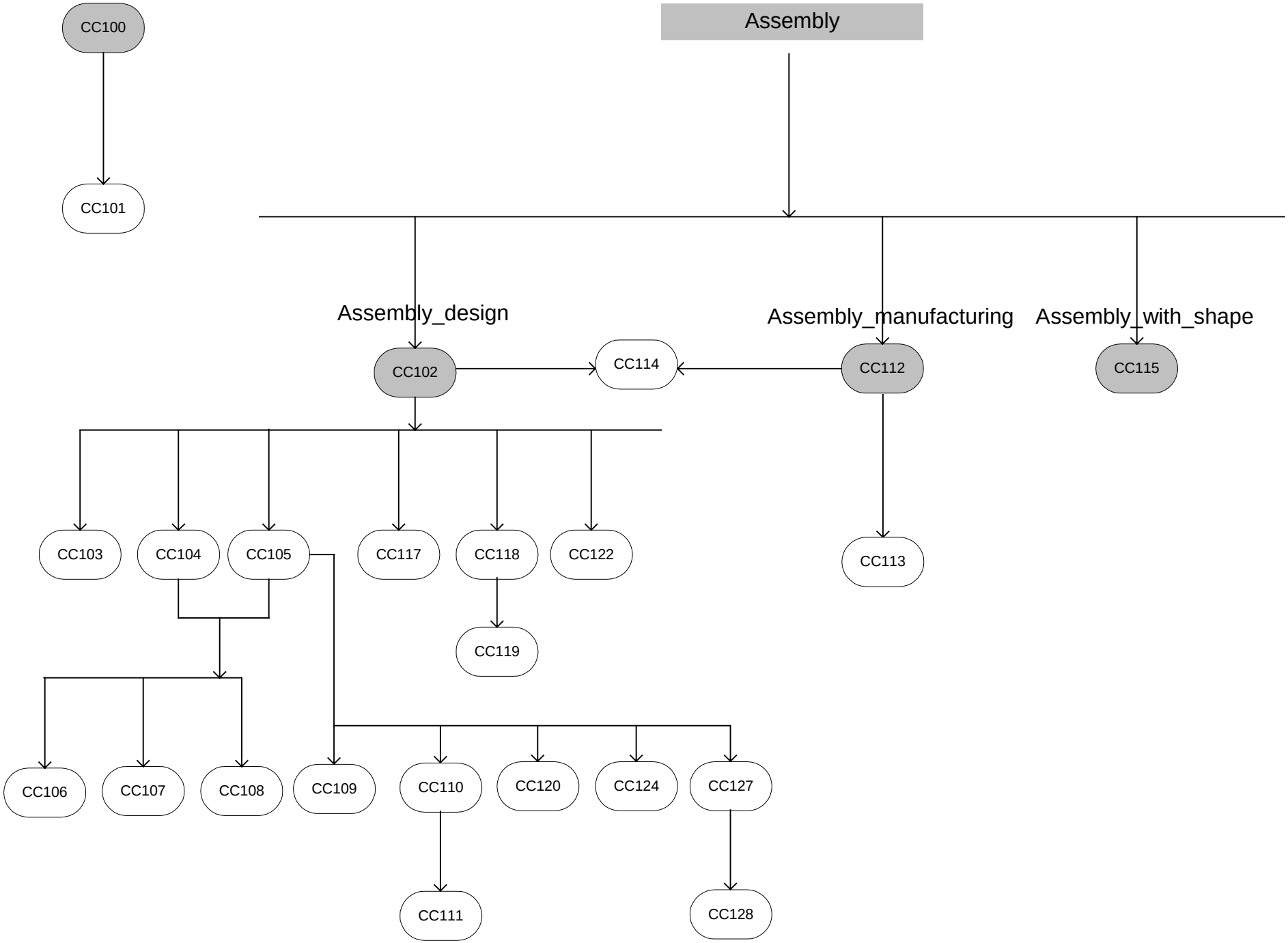

CC281
CC290
CC291
CC284
CC278
CC279
CC280
CC282
CC283
CC285
CC286
CC287
CC288
CC289
CC287
Feature
CC267
Feature_volume
feature_cutting
Feature_edge_chamfer
Feature_surface
feature_thread
CC268
CC269
CC270
CC271
CC272
CC273
CC274
CC275
CC276
CC277

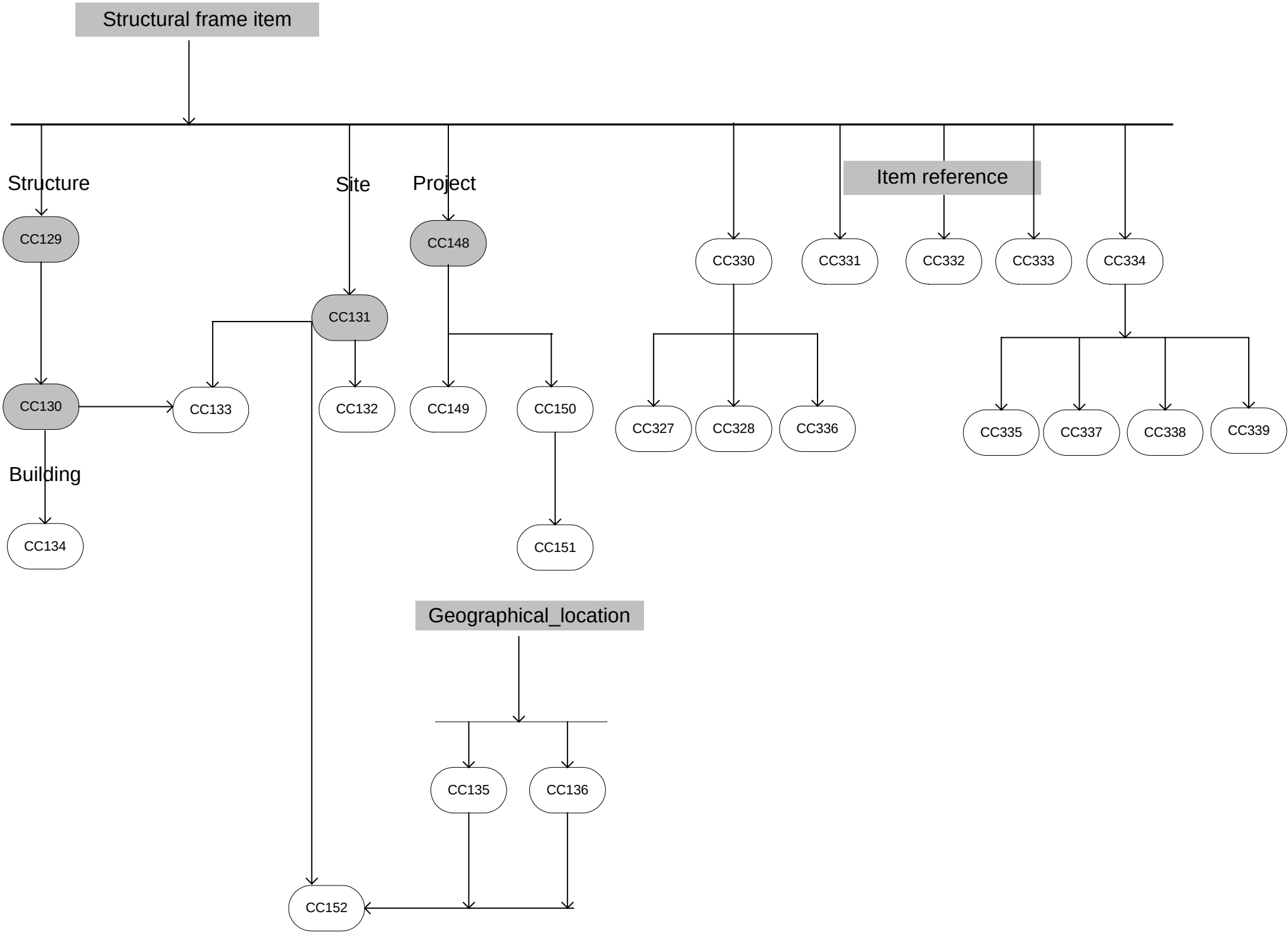

Joint_system
Joint_system_mechnical
Joint_system_welded
Joint_system_amorphous
CC293
CC300
CC294
CC298
Fastener
CC292
CC295
CC296
CC297
Material_isotropic
CC292
CC301
CC302
CC303
CC304
CC306
CC307
CC308

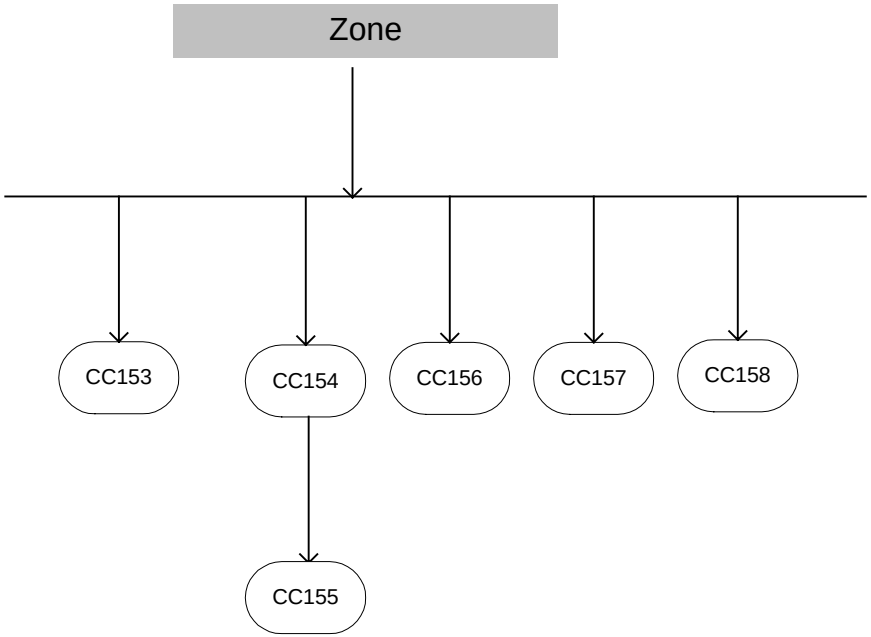

Coord_system_cartisian
Coord_system_cartisian_3d
CC309
CC310
CC311
CC312
CC315
CC317
CC313
CC316
CC318
CC321
CC322
group of data
CC319
CC320
CC322
CC323
CC324
Section_profile
CC325
CC326
CC329
CC327
CC328

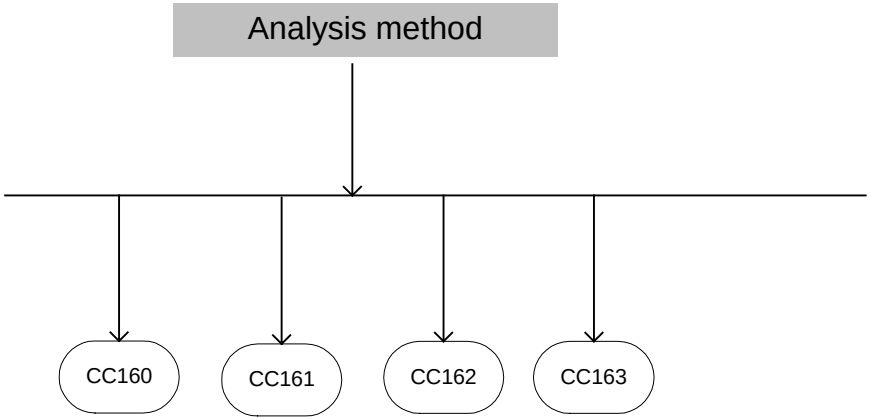

Grid
CC137
CC138
CC139
CC140
CC141
CC142
CC144
CC145
CC146
CC143

Managed_data_item




Structural frame item
Structure
Site
Project
Item reference
CC129
CC148
CC330
CC331
CC332
CC333
CC334
CC131
CC130
CC133
CC132
CC149
CC150
CC327
CC328
CC336
CC335
CC337
CC338
CC339
Building
CC134
CC151
Geographical_location
CC135
CC136
CC152


Zone
CC153
CC154
CC156
CC157
CC158
CC155


Analysis method
CC160
CC161
CC162
CC163