Overview of CIS/2 (expanded)

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Introduction

CIS/2 (CIMsteel Integration Standards, Version 2) is the outgrowth of ten years effort by Leeds University (UK) and SCI (Steel Construction Institute). Version 1 was implemented in 1995, whose testing and refinement led to Version 2 in 1999. The main changes in Version 2 included covering many more conditions encountered in structural steel design and fabrication and closer consistency with the ISO-STEP exchange models and practices. Version 2 also began to address the data management issues required of production exchange.

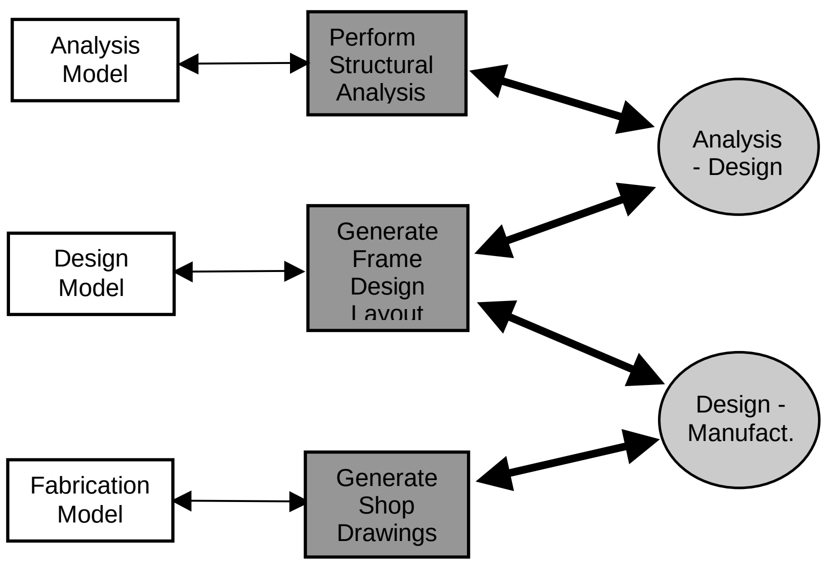

Figure One: A simplified process model identifying the various CIS/2 views and major exchanges, supported by high-level conformance classes.

The general structural steelwork lifecycle being supported is that shown in Figure One. The figure is a high level overview of the process model presented in Chapter Three of the CIS/2 documentation. It points out that the structural steel frame for a building goes through three major stages (shown in blue): (1) Analysis, (2) Design and (3) Fabrication. Each of these have their own CIS/2 data model to and from which exchanges can be made. There are many variations of the models and many datasets are mixtures of several models. For example, the need to detail joints based on the analysis results requires that the detailing model also carry some of the analysis model data. The elements in the three models are linked, so that an analysis elements for a design member may be examined, or its role in a manufacturing assembly. Because there are three models, the models defined at a previous stage of design can be accessed and compared with more recent stage models. In addition there are optionally versions of models at each stage. Two major transitions between these three stages are identified—between analysis and design, and between design and manufacturing. The assumption of the model is that development of a steel structure may have to iterate through the three stages more than once.

The three different models of a steel structure are called “Views”. The Analysis View names its parts as “Elements”. The central Design View names its parts as “Members”. The Fabrication View names its parts at “Parts”. This naming convention can be helpful in identifying EXPRESS Entities that support the three different views.

The CIS/2 data model called the Logical Product Model (LPM). It is currently in Version 5. LPM/5 supports the engineering of low, medium and high rise construction, in domestic, commercial and industrial contexts. The main structural steelwork and the secondary steelwork (purlins, siderails, cleats and cladding) are covered. Frames can be braced or unbraced. Connections can be considered to be pinned, rigid, or semi-rigid; - the latter two being full or partial strength. The frames are fabricated from manufacturing assemblies, which in turn, are made up of parts and joint systems. The parts can be rolled sections, plates and sheets or castings. Joints can be bolted, welded or pinned. Although the CIS has been developed primarily to enable the engineering of building frames, it can also be applied to other types of steel frame, such as process plant installations, transmission towers, and (to some degree) offshore structures.

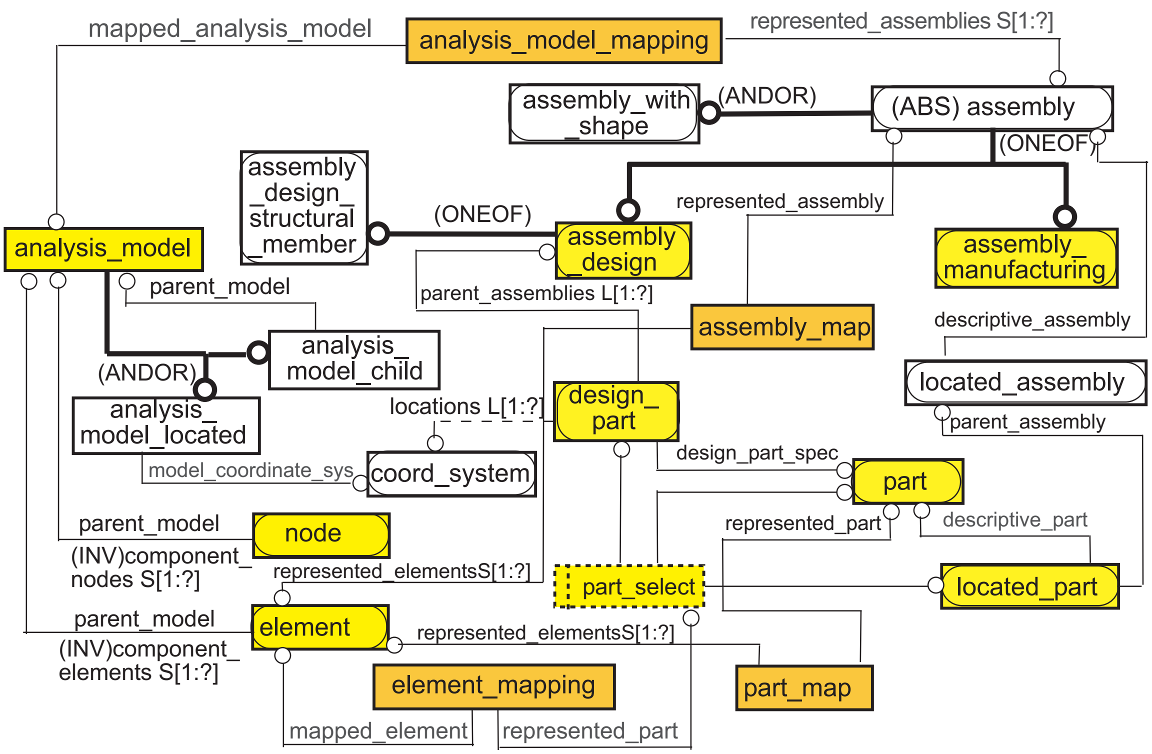

Figure Two: An overview of the high level entities making up CIS/2.

Overview of the CIS/2 Product Model

The high level structure of the CIS/2 Product Model is shown in Figure Two. The three different types of models are shown in across the upper third of the model. On the left is analysis_model, which is the structure for carry the elements and nodes making up an analysis model. It also carries loads and reactions.

The design model is shown in the middle of the figure, aggregated as assembly_design. It is made up of a number of design_parts which is a template of a part which may have several locations, each signifying an individual. A design_part refers to a part. The part is a specification of a rough cut member, with a given section profile.

The fabrication model is grouped under assembly_manufacturing. It is referred to by the set of located_assemblies that are composed of located_parts that are the detailed members comprising an assembly. The located_part also refers to a part for its rough cut specification. Detailing such as copes and notches are associated with located parts.

There are a variety of cross links or maps between parts and elements defined in the various submodels. It is desirable to identify for each element the located_part or design_part it is part of. This is defined by element_mapping, which can refer to a design_part, a located_part or a part. Sometimes, an assembly, such as a truss, is directly decomposed into elements. In this case, assembly_map defines all the elements associated with the assembly (possibly a assembly_design or an assembly_manufacturing.) The last kind of cross link is part_map. It defines the elements that are associated with a part (keep in mind that a part may be repeated many times).

Each of these cross links are at the element or part level. If an analysis model has been used to analyze an assembly, a high level cross link can be used to identify this association. This cross link may be especially appropriate when a simplified analysis_model may be used to analyze an assembly_design or assembly_manufacturing.

Each of the three types of model, analysis model, design model and fabrication model are described in more detail in separate tutorials.