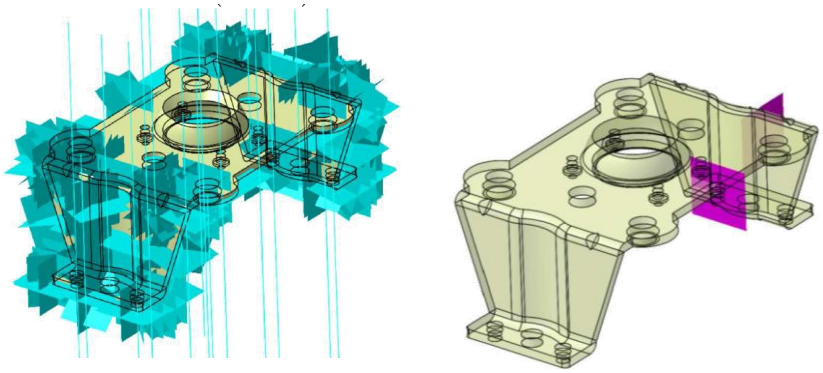
Shape symmetry analysis and editing using a multi-level object representation



Some local and global symmetries on an object

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Context

Recently, symmetry analysis has found many applications in computer graphics [1, 3]. This observation applies to CAD models as well [2]. Symmetry properties play an important role in man-made objects and partial symmetries are also of particular interest to structure these object shapes.

Pre-requisites include interest and skills in applied geometry (for instance, MoSIG's second year course "Computer Graphics II" or/and “Computational geometry”).

Objectives

Components of industrial products are often modeled from sketches and primitives through extrusion and revolution operators. As a result, these components may exhibit multiple local symmetries as well as some global ones [1, 2]. In computer graphics, objects are currently described as meshes. Also, digitized objects are often described with meshes. Large meshes as well as bad quality triangulations are often encountered and form limitations when processing models for symmetry analysis. Here, the purpose is to address these issues through a multi-level representation of the analyzed objects. To this end, a first phase is the generation of analytical surfaces from the input mesh [4] to cluster triangles and associate one of the geometric primitives: plane, cylinder, sphere, cone or torus to each cluster. The symmetry analysis is then performed on the higher level description of the object using these primitives. To preserve, the efficiency of the approach, the object boundary described from these primitives is not evaluated geometrically, i.e. there no computation of intersection curves between the primitives.

As a result, the object structure thus obtained will form the basis of high level shape edition operators applicable to mesh models.

This project will be carried out in the context of a collaboration with a research laboratory abroad.

Development will be carried out in C++; will use a pre-existing software being developed within the framework of the collaboration.

Keywords: symmetry, decomposition in primitives, shape simplification, modelling process.

References

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