Chapter 2
From Modeling to 3D Printing

ABSTRACT

Geometric or 3D modeling playing key role in geometry definition. These modelers evolved from wire-frame models to Boundary representations or CSG models in solid modeling or Bezier spline or Non-uniform rational B-spline representation. After modeling process, using internal representation, part will be post-processed for manufacturing. Variety of postprocessors existing, and using unique G-code standard we producing on CNC machines requested parts. 3D Printers use the same G-Code standards with extensions for more than ten M functions that programmers use for setting 3D printing parameters different than we using for CNC manufacturing. List of M functions varies depend of the manufacturer.

INTRODUCTION

One of two key components in the process of part production (regardless of whether it is about additive or subtractive manufacturing process) is producing 3D model of the part. We use techniques of geometric modeling to form regular part. Geometric modeling is as important to CAD as governing equilibrium equations to classical engineering fields as mechanics and thermal fluids. Role of geometric modeling is:

- To make intelligent decision on the types of entities necessary to use in a particular model that meets certain geometric requirements such as slopes and/or curvatures.

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- To interpret of unexpected results.
- To provide evaluations of CAD/CAM systems.
- To innovative use of the tools in particular applications.
- To create of new attributes, or modify the obtained.
- To provide models to benefit new engineering applications.
- Understanding of terminology.

In the heart of the system is mathematical representation (database). Database is connected with mathematical engine, module that performs all mathematical calculations to forming good representation of 3D model. All necessary inputs can be entered to the system via user interface. Output can be provided via computer display and drawing generation interface and devices. Geometric model must be ready for further analysis such as Finite Element Method (FEM) and manufacturing (Computer Aided Manufacturing - CAM with postprocessors).

To perform this, every geometric modeler must satisfy general requirements, such are:

- 3D model must have complete part representation including topological and geometrical data. Role of topology is to keep links about the connectivity and associativity of the object entities; it determines the relational information between object entities.
- Ability to transfer data directly from CAD to CAE and CAM.
- To support various engineering applications, such as mass properties, mechanism analysis, FEM and tool path creation for CNC, and so on.

Role of Topology

Role of implemented topology is to keep correct internal representation of the object. Today this is part of all internal representation, but originally this was part of solid modeling representation. We calling this representation: boundary representation (or B-rep) of the object. Boundary representation represent solid object by segmenting of his boundaries on the finite number of boundary sub-sets on three levels: by faces, edges and vertices. (Kocovic, A Relational Database for Representaion of Machining Parts, 1987) (Kocovic, Geometric Modeling using Euler Operators (in Serbian), 1987) We dividing boundary on set of faces this does not intersect each other except in common edges and vertices. Every face is set of edges and vertices.