Geometric Search Enhances Product Development

CIMdata Brief

The ability to search on text-based information has become common practice for people all across the product development spectrum. However, searching for items based on geometric shape has not been generally available until recently. New tools to support searching on 2D and 3D shapes can have a profound effect on product development. This CIMdata Brief examines benefits and issues that arise when product developers employ geometric search capabilities to find data and in particular, how a new tool, Bingo!, supports this important knowledge capture and reuse capability.

Businesses today need to encourage innovation and creativity in the products they design. They do this to better satisfy customer needs and to enable growth in both old and new areas by delivering products that are compellingly valuable to the customers they serve. Innovation in product design needs to be supported by solutions that allow product developers to efficiently evolve creative new product designs from previous designs. This can be supported by reusing parts and components that have been successfully used in previous product developments while avoiding those that have been rejected in the past.

In order to support this, designers need to be able to find product designs that match, or closely match a design concept they are pursuing. There are many ways in which people search for data. As examples, they can search for text via full-text searches in documents, drawings, databases, etc.; they may narrow a search by looking through a pre-defined set of attribute data such as material, labels, names, dimensions, etc.; and they may search on very specific key data such as part number. Because different designers name things differently, company standards vary by location, and languages differ by geographic region; none of these techniques is universally accurate. Also, they cannot find part designs that are similar to or may be substituted for the part that they are creating. This requires an evolving form of searching that allows 3D shapes to be found.

2D search is interesting for finding differences in drawings and CAD sketches so that duplicates and modified data can be discovered in designs that may have been created before 3D CAD was placed in use. 3D search allows a number of additional important search opportunities. Most important of these is the ability to find previously-designed parts that approximate or exactly match a proposed new design. When previous parts are found, several immediate benefits accrue. First, a pre-existing design has the advantage of having been used in products that have already passed through multiple tests including standard engineering analyses, prototype testing, and quite possibly testing in service. Thus, their quality (or lack of quality) is well understood and they can be used (or avoided) with confidence in their quality and without the need for re-testing. Second, geometric search can identify and report on the number of duplicate designs and drawings that are maintained by a company so they can be reduced. 3D search can be used to determine where duplicate parts are used in different products or under different part numbers or names; duplicates that cause inventory bloat raise costs when they are sourced to different suppliers and complicate in-service maintenance and operations. It is important to

consolidate duplicates out of circulation, but most companies have to rely on happenstance and luck to find duplicate parts. A system that can automatically search the company's parts design inventory to identify duplicate (or nearly duplicate) parts can provide a substantial economic benefit.

Geometric search provides a relatively simple way to build parts classification libraries. Classifications based on shape searching are much more accurate, easily created, maintained, and are easier to access than those based on alphanumeric encoding.

The Bingo! product from Sconce (http://www.sconcesolutions.com) offers a broad range of 2D and 3D search capabilities. Because Bingo! provides both 2D and 3D searches based on 2D sketches, including sketches cut-and-pasted from tools such as MS Paint, orthogonal-views, 3D part and assembly definitions, or photographs of actual objects, it is relatively easy to use within a designer's CAD environment. Bingo! can search for parts that are dimensionally close to the base shape. This allows parts with similar shapes but different sizes that are close to the base part to be found, broadening the options available to designers. Searches can also be based on a surface. For instance, a mounting pad can be defined with hole locations, and parts that align with and are likely to mate properly with the mounting pad will be found. A short list of Bingo! capabilities includes:

- Search for 3D parts or assemblies of parts
- Search for drawings and searching for 3D models using drawings
- Search using a built-in sketch tool
- Search on native CAD data
- Search based on a surface of a 3D model
- Search and navigate through the collection of 3D data visually
- Produce reports:
  - Identify duplicate parts
  - Identify suitable substitute or replacement parts
  - Identify duplicate parts across two different PLM system databases
- Bingo! scales to support small as well as large companies
- Extendable architecture that allows integration with 3rd-party CAD and PLM solutions

Bingo! can be integrated to PLM data management and CAD environments so that geometry can be used to search through large quantities of design data to find matching and similarly shaped parts and drawings. Sconce has direct interfaces into PTC's PLM solutions and Pro/ENGINEER, AutoCAD, Inventor, and SolidWorks CAD solutions. Bingo! can derive reports of parts and drawings that are duplicates or nearly duplicates, allowing companies to reduce parts counts by eliminating duplicate parts. Bingo! can also support developing parts classification schemes and automatically identifying parts that fit in a particular class. Given its broad set of capabilities, Bingo! provides an interesting shape search engine that is independent of the CAD formats commonly in use today and is well worth evaluating.

As described in this brief, there are a number of very compelling benefits that accrue from employing geometric search capabilities. Because it is a fairly new concept, searching based on shape has not generally been implemented today. However, early adopters of geometric search are learning that its use can significantly impact their product development and innovation processes.

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