ACHIEVING NEW LEVELS OF ROI FROM YOUR CAD / PLM INVESTMENT

For decades, CAD and PLM technology have helped companies improve design quality, shorten production cycles, spur collaboration, and increase designer productivity. But, for all the benefits these tools offer, CAD and PLM also have limitations that present challenges to engineers and manufacturers.

Two significant challenges include finding existing models saved in the PLM library and errors resulting from converting design files from one CAD system to another.

Due to these obstacles, engineers spend between 30% and 50% of their time searching for designs, correcting inaccurate design models, or creating redundant designs from scratch. This wasted time and effort add up to more than $37,000 per engineer per year.

Let's examine each of these disadvantages further.

Engineers spend between 30% and 50% of their time searching for designs, correcting inaccurate design models, or creating redundant designs from scratch.

$37,000

This wasted time and effort add up to more than $37,000 per engineer per year.

INABILITY TO FIND CURRENT DESIGNS

It can be difficult for engineers to find models in the PLM library for a variety of reasons. Perhaps the engineer who designed the original part didn't adhere to file naming standards and used a vague file name. Or maybe the engineer is searching for the design by part name, but the model is saved under the part number.

A related issue is finding the most current design among several versions. Engineers enhance models all the time, and sometimes these new files replace older versions, but often this exercise results in multiple files of the same model with minor changes. Determining which is the true version from which to work means manually comparing various designs to understand how each has evolved.

For a small machine shop, manually sifting through a hundred files to find a specific design might mean a few hours of lost productivity, but for large companies that have millions of CAD files stored in their PLM system, finding the original model could be impossible.

Regardless of why an engineer can't find a specific design, the result is often the same—the engineer recreates the model from scratch to suit their current need, which adds another version to the PLM library and exacerbates the problem for another engineer down the line.

CAD SYSTEM CONVERSION ERRORS

Different CAD systems don't produce the same file type, and as a result, companies using multiple CAD systems have to convert models from one file type to another when switching between CAD systems.

This creates a problem because exporting a model from one file type to another introduces slight errors during the conversion process. The converted model might be 98% accurate, but that 2% deviation from the original is enough to compromise the integrity of the design.

This problem is also evident when companies transition from one CAD system to another

and have to convert and import all of their existing designs from their legacy system into the new system.

The inability to find (or trust) a current design in the library and CAD system conversion errors results in hundreds of hours of lost productivity, duplicated efforts, and lost revenue.

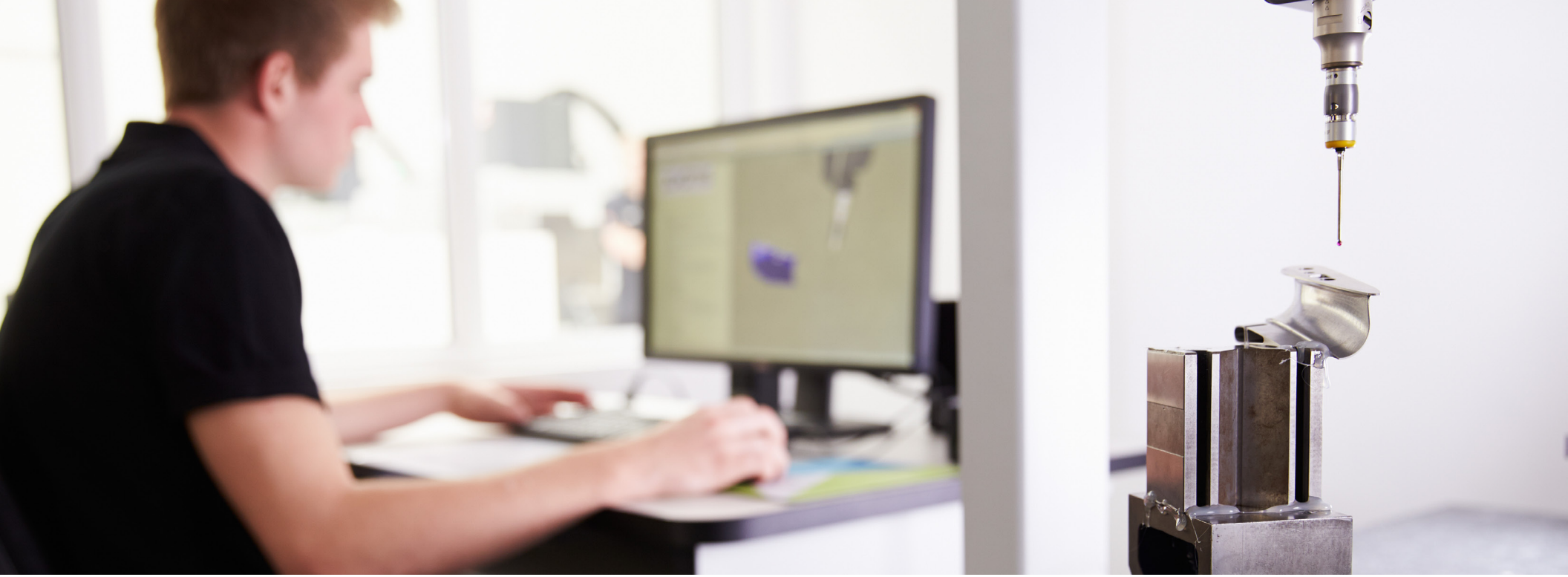
CHANGING THE WAY ENGINEERS SEARCH FOR DESIGNS

A new geometric search capability is changing the way engineers locate designs in PLM systems. CAD and PLM systems use a text-based search function to find models in the database, so unless the engineer looking for the model knows the exact text to use during their search, they may have a problem finding the source file.

Geometric search takes the guesswork out of finding designs because it doesn't rely on file names, part numbers, or other metadata fields. Instead, geometric search relies on the design's physical and intrinsic attributes.

There are multiple geometric search plug-ins available, and each uses a different proprietary approach for design recognition. One application works by breaking down a model into "mesh" triangles and then measuring each triangle to develop a pattern that it can compare to other models. Because the measurements between mesh triangles never change, this geometric search plug-in has a significant level of accuracy, enabling engineers to search for designs based on a variety of attributes, including:

- PERCENTAGE OF SIMILARITY
- COMPLIANCE STANDARDS
- TAGS
- ALIGNMENT



- MATERIAL
- COST
- SET TOLERANCE

For example, let's say an engineer has a bracket, but he's unsure what it is or in what application it is used. He or she can measure the diameter of one of the holes and run a geometric search using only the hole diameter. The engineer can then see all of the designs in the entire PLM library for components using the same diameter hole.

RECAPTURING LOST PRODUCTIVITY AND REDUCING ERRORS

The benefits of geometric search go far beyond making it easier to find existing designs. Specific geometric search plug-ins can also eliminate productivity losses as a result of duplicating parts and reduce errors from CAD file conversion.

For example, Physna's "auto fill" capability compares the physical attributes of an engineer's current design against known models in the library and will alert the engineer if the model they are creating is similar to one already saved in the database.

This is invaluable in situations where an engineer does not look for a model in the PLM because they are certain it doesn't exist. Once an engineer begins creating a new model, the Physna tool compares the design to other models in real time and alerts the engineer to duplicate design files.

Further, because engineers can use this plug-in to compare multiple designs of the same component, it's simple to identify differences between versions and address errors before a design goes into production. If an engineer finds inconsistencies in multiple models, they can isolate that specific attribute and search for all other designs with

the same defect. They can also track versions to see how a model has changed over time to ensure the correct version is represented in the library.

FINDING PARTS WITHIN ASSEMBLIES

An aircraft can have more than five million individual components. In the case of an aircraft wing, the wing is comprised of various assemblies and sub-assemblies. The Physna plug-in enables engineers to quickly identify parts that are buried inside sub-assemblies and compare larger components to one another.

This ability is crucial when comparing two nearly identical aircraft wings at the sub-assembly level to determine how they are different. Without geometric search, an engineer would have to look at each component individually to find discrepancies.

INCREASING COLLABORATION ACROSS DIVISIONS

Often, different divisions within the same company might need to design a similar component. If these divisions are not collaborating, they will have no idea what models already exist and will likely create their own design from scratch.

Consider this example: a pump manufacturer has two divisions, one servicing the chemical industry and another servicing the foodservice industry. An engineer in the foodservice division realizes the need to develop a specific type of pump for an application. Using geometric search, they can determine if any of the company's other divisions have a pump design that they can either use "off the shelf" or modify to their specific requirements.

Without this insight into another division's design models, it's likely the engineer in the foodservice division would begin the time-consuming and expensive process of creating a redundant model.

REDUCING COSTS BY ENHANCING ORDERING EFFICIENCIES

Geometric search can also help companies cut costs by improving ordering efficiencies across their company. Company divisions often manage their own purchasing and have little insight into the parts other divisions order.

With some geometric search plug-ins, a company's procurement or purchasing division can search for all of the assemblies that use a specific part, for example, a 10mm bolt, across all of its divisions, worldwide. With this visibility, the company can then standardize ordering to take advantage of volume discounts on all units purchased across the company.

BENEFITS FOR MANUFACTURERS

The benefits of geometric search aren't limited to engineers. Manufacturers can use the tool to determine whether they can produce a specific part for a customer, reduce defective parts, and auto-evaluate material requirements.

Consider these benefits:

Ensure compliance with standards. Companies use design standards to ensure their parts meet specific company and industry guidelines. Manufacturers can use geometric search to confirm the parts they're designing for their clients meet that company's standards, reducing the likelihood of errors and the need to re-manufacture

> ***"Without geometric search, an engineer would have to look at each component individually to find discrepancies."***

parts because they don't meet the client's exact specifications.

Reduce manufacturing errors. Manufacturers can use geometric search to inspect part designs before production. This ability reduces the chance of producing a part from a corrupted file, an old version of a model, or a design that is inconsistent with the standard.

Streamline logistics. Custom standards help manufacturers immediately know which machines, lines, or locations can produce which products for which client. Having this insight eliminates guesswork and shortens production cycles.

Automate pricing. Because geometric search can calculate material volumes and costs based on the model, manufacturers can automate pricing and create more accurate estimates.

Efficient use of scrap materials. During downtime, CNC operators can use geometric search to make efficient use of their spare raw material stock. By running a geometric search based on the type and amount of scrap raw material they have, CNC operators can identify the specific components they can machine.

CYBERSECURITY BENEFITS

Today, it's more important than ever to protect part designs from external threats. It only takes a simple virus introduced via a malicious email to compromise a model. Design changes undetectable to the naked eye can have devastating consequences.

Manufacturers can use geometric search to time stamp their designs and confirm no changes have been made to the model before sending it out for production. If the system detects a change, engineers can compare the design to earlier versions to see exactly how the model has been modified and confirm it has not been compromised from the outside.

CONCLUSION

Engineers spend between 30% and 50% of their time correcting inaccurate design models, searching for designs, or creating redundant designs from scratch. While not all geometric search applications perform the same, specific plug-ins can eliminate this wasted time and effort and restore productivity to the tune of $37,000 per engineer per year.

More importantly, these capabilities enable engineers to focus on their core responsibilities—designing and building solutions to overcome technical problems.

PAUL POWERS

Co-Founder and Chief Executive Officer, Physna LLC

ABOUT THE AUTHOR

Paul Powers co-founded Physna (physna.com) in 2015, creating patent-pending software designed to increase efficiency with CAD design, engineering design, and quality control. Physna technology can compare and analyze thousands of 3D models in seconds.

He manages corporate direction and strategy at Physna, facilitating company activity in innovation, sales, consulting and marketing alliances. Powers is experienced in creating tech companies designed to increase efficiency and sparking innovation. Powers is also the founder and CEO of Zoozler LLC, a tech innovation firm assisting startups with business development and fundraising.

In 2019, Powers was recognized by Forbes Magazine as one of the brightest young entrepreneurs in the United States. Powers will participate in the Forbes Under 30 Summit in October with other young entrepreneurs, visionaries and disrupters across the country.

Powers has presented on the TED Talk stage and at several tech startup conferences like StartUp Grind and Startup of the Year at SXSW.