

Providing a virtual manufacturing environment for prototype development

IDC researchers are working with St Gobain Performance Plastics Bearings to improve design success through developing modelling tools to produce component prototypes in a virtual environment.



Tolerance rings are curled metallic rings with corrugations formed around the circumference that act as springs enabling optimal joining between components as they are press fitted between a frame and a casing for easy, quick and low-cost assembly. They are used in a wide variety of everyday products, for example, to reduce the noise from a squeaky car seat or vibration in a washing machine drum. Despite appearing to be relatively simple, there are a multitude of considerations needed in their design to produce an effective product; e.g. ring shape, material type and their “wave” which interacts with the components the ring is “mated”.

St Gobain Performance Plastics Bearings have developed

their processes over many years based on the significant expertise and experience of their staff in designing, practical testing and refining components. However, as the applications of their product ever more technically demanding this way of designing became increasingly difficult to sustain and they needed to innovate to more effectively model their products prior to design.

What the IDC did

Following on from a previously successful Knowledge Transfer Partnership (KTP) with the company, the IDC’s Research Engineer sought to develop modelling tools using Finite Element Analysis (FEA) software. Initially FEA models

were developed, tested and implemented for manufacturing processes. After proving these, the focus switched to automating the models, re-checking their functionality and carrying out post process analysis to ensure reproducibility and quality.

This led to the development of a Virtual Manufacturing Environment (VME) tool which, by providing it with parameters and data inputs, could produce virtual prototypes for use in testing and design checks. This enabled St Gobain Performance Plastics Bearings to begin designing their products to fit inside new customer designs before customer prototypes had been provided.

St Gobain Performance Plastics Bearings exports more than 80% of its products to Europe, US and China. The project helped strengthen relationships with its globally distributed customer base as the tools imparted confidence in the designs and iterations in product definition were reduced from around ten to two, saving time, money, resources and further enhancing the company’s reputation.

The Impact

The outputs of the project have changed the way that St Gobain Performance Plastics Bearings designs its tolerance rings, significantly reducing the time to full product definition and has helped in providing a more comprehensive service offering to its customers. Some key benefits included:

- The outputs of the EngD could be implemented directly during the project providing immediate impact from the research and incorporate feedback from across the internal supply chain.
- The FEA team at St Gobain Performance Plastics Bearings has increased in size from 1 to 4 to provide the necessary in house virtual design resources.

- Product design teams using FEA located on other global sites within St Gobain Performance Plastics Bearings are using the tool with support from the central team.
- The Research Engineer was recruited by St Gobain Performance Plastics Bearings to further develop the Virtual Manufacturing Environment tools and to install them in to the design process at ever more detailed levels.
- The project outputs have received very positive feedback from customers and have helped to enhance the company’s reputation with its client base and secure further orders.
- The developed tools are now used in around 80% of projects in the original application area with growing use in a number of other application areas.
- The company recognises the benefit of the modelling approaches and has moved away from discussing the cost – benefit of such approaches to making it a cornerstone of its processes.

The Future

The tools have been largely applied to the tolerance ring product lines to date which produce around 200 million rings annually, although the modelling and the approach is progressively being developed and applied for additional product lines, which is providing a new set of challenges for the tools. If the Virtual Manufacturing Environment tools can be successfully applied to this product line it could provide the company with further performance improvements, associated resource savings and further increased customer satisfaction and confidence.

