CADfix®

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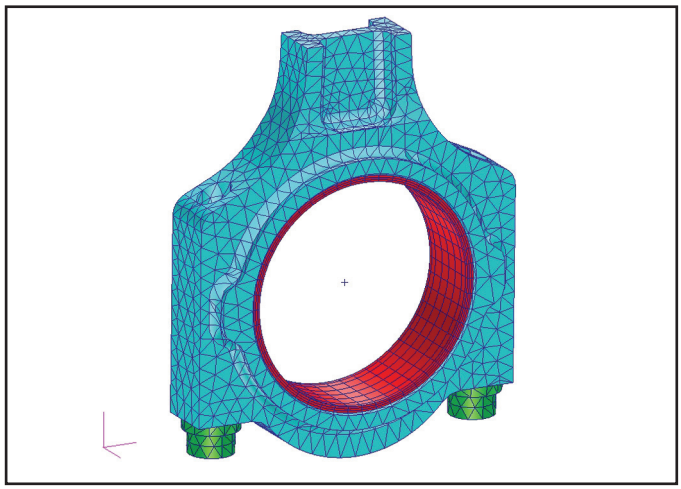
CADfix makes load more bearable at Glacier Vandervell

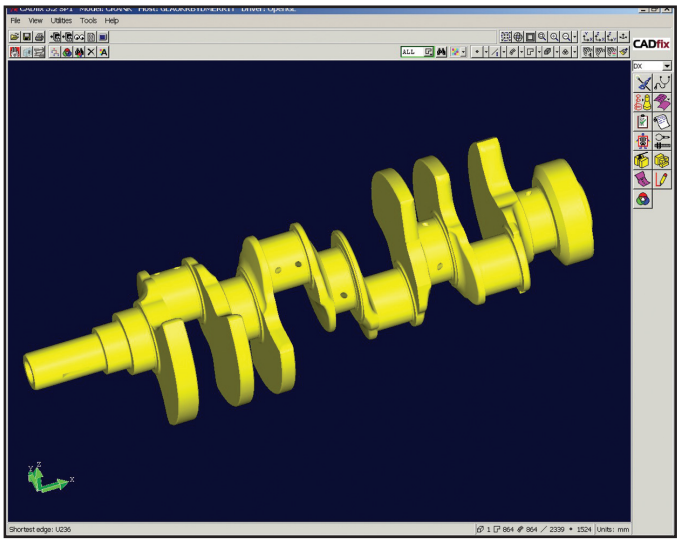
Glacier Vandervell is a major international supplier of engine bearings for the world's automotive industry to original equipment (OE) and aftermarket customers. The company has manufacturing facilities in the UK, US, France, Italy and Slovakia and supplies a wide range of applications from small petrol engines through to Formula 1 and large diesel engines. Glacier Vandervell is part of the Dana Corporation, a $10.3bn multinational automotive components supplier.

Glacier Vandervell's global technology centre, and the focal point of its worldwide research and development activities, is based in Rugby, Warwickshire. The centre is home to the Advanced Bearing Technology team. The main focus of its activity is on developing techniques for the analysis and design of engine bearing systems. The techniques involve using commercial software to perform finite element analysis (FEA) of engine bearing structures, coupled with in-house developed computer programs for performing elasto-hydrodynamic lubrication (EHL) analysis of the bearing system.

David Merritt is a senior engineer in the advanced bearing technology department working on the finite element modelling of customer components. "We develop software tools for analysing bearings under engine operating conditions," explains Merritt. "It's essentially a free service to customers who are using our bearings or developing engines with our bearings in them."



3D mesh of engine bearing



Crankshaft in CADfix

Get your bearings

A bearing is a steel shell coated in a specialised bearing material, typically about 2mm thick and about 15mm wide. It is used to transmit a load through two elements of an engine moving relative to each other. The structure is fairly simple but the interactions between the bearing and the rest of the engine can be quite complicated. Much of the research at Glacier Vandervell goes in to developing bearing materials that give better performance in terms of wear and resistance to seizure and fatigue.

If there is a problem with a bearing system in an engine or if a customer wants to look at different bearing designs or engine structures, the Advanced Bearing Technology team can perform analyses to highlight where the problems might be occurring and how they can be solved. This could involve changing the shape of the bearing, adding different features to it, changing the bearing material or going one step further and actually changing the structure of the engine.

"We analyse the bearings in the engine using a piece of software that we've developed, called Sabre-EHL. This performs an elasto-hydrodynamic analysis of the engine bearing, which couples the pressures generated in the oil film with the flexibility of the engine structure," says Merritt. "The process of setting up the analysis involves receiving CAD models from our customers, usually the connecting rod or engine block plus the crankshaft. The first task is to translate these into the software we use for the pre-processing."

The matrix reloaded

The engineering team uses MSC.Patran for mesh generation and analysis set-up. The model is then analysed in ABAQUS to obtain a stiffness matrix for the bearing surface and also the deformed bearing profile due to the interference-fit of the bearing relative to the housing during the bolt-up procedure. The data is fed in to Sabre-EHL, which performs the calculations. “I’m mainly involved in that process,” explains Merritt. “Receiving customers’ models and generating the stiffness matrix and then going on to do the engine bearing analysis.”

Usually, the OEM specifies the application and dimensions and Glacier Vandervell recommends the type of bearing that would best suit the job. At this point there is a testing programme and the bearings are inspected after certain test procedures. “We take all the dimensions of the structure, the stiffness and the loads that are applied and use this information to perform a lubrication analysis taking into account the oil film,” says Merritt.

At a basic level the bearing only survives because there is a very thin oil film separating it from the crankshaft. The crank is riding on a film of oil, which may be no more than 0.1 of a micron thick in some places. It’s the success of that oil film in keeping the two surfaces apart that determines how well the bearing performs.

Solid solution

Because the engineers at Glacier Vandervell are dealing with CAD models from customers, the ability to translate data reliably and accurately is a major issue. In the past the process of getting a customer’s model into a form that could be meshed was a time consuming one.

“We have Pro/Engineer here so we’re able to take Pro/E files from customers. We use MSC.Patran for pre-processing and are able to import Pro/E files via a direct link. This is fairly successful but not 100 percent reliable. In the past for all other CAD software we had to rely on an IGES file. It was the amount of time that that process was taking that led us to think that it would be good to look at CADfix,” says Merritt.

CADfix is a suite of translation and repair tools for engineering product data that facilitates true interoperability between a comprehensive selection of CAD, CAM and CAE systems. The software, with its host of knowledge-based automated healing tools, removes significant barriers that can hamper the reuse of solid models.

“We’d heard of the product because Glacier Vandervell has historical links to the FAM software which went on to become CADfix,” explains Merritt. Just over a year ago the company visited the ITI TranscenData stand at the Solid Modelling show in Birmingham and purchased the CADfix software after an on-site demonstration showed the potential for real productivity gains.

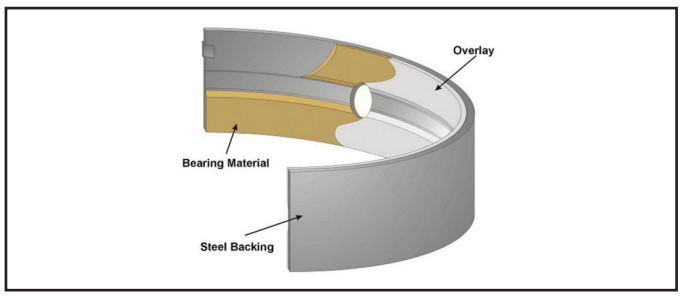


Diagram of a bearing

Glacier Vandervell bearings

Productivity gains

The benefits Glacier Vandervell has experienced through its adoption of CADfix are typical and illustrate the importance of meeting the challenge of engineering data interoperability head-on. “We use CADfix as a tool to get data into a form we can use as quickly as possible. The real benefit to us is time saved,” says Merritt. TranscenData’s own research suggests that up to 80 percent of a typical engineering design project is wasted on reworking data.

More and more manufacturers are turning to CADfix because they employ qualified engineers to engineer things, not to spend their time remodelling CAD files from scratch. Merritt concludes: “We are saving between a half and four man days per project depending on the complexity of the model. In percentage terms, the amount of model re-working has been reduced by around 90 percent and the total model set up time reduced by around 50 percent.”

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