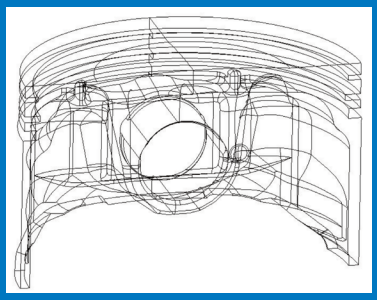
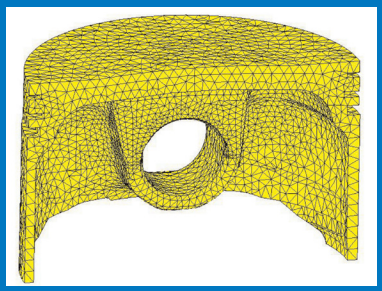
Federal-Mogul Pins Success on CADfix

CADfix

CADfix removes barriers preventing the reuse of solid models. By providing an extensive set of geometry manipulation tools for importing, repairing and exporting data, CADfix maximizes the reuse of CAD data in downstream applications.



Piston head as an IGES wireframe



FEA mesh of piston head

The finished product

Organizations that supply components for automotive manufacturers are increasingly expected to provide services like design validation and engineering analysis. This means that suppliers' design and engineering departments are under a far greater burden and are turning to increasingly sophisticated levels of technology to fulfill their commitments.

When it comes to first-tier suppliers, it is difficult to think of one more fundamental to a car's performance than Federal-Mogul Powertrain. Representing 35 percent of the Federal-Mogul Group's $7 billion business, the Powertrain Systems division supplies piston assemblies for most of the major automotive manufacturers. Its components are used in engines for cars, light vehicle diesel applications and heavy-duty diesel trucks from manufacturers across the automotive spectrum.

FEA Pioneers

Federal-Mogul is conscious of the need to provide up-front analysis and validation services. In fact, the design office has been a pioneer in the field of finite element analysis (FEA) technology for the past 12 years.

"When we first started using FEA, we had a 40-strong group of designers all still using drawing boards," explains Dr. John Dowley, Design Manager at Federal-Mogul UK. "At that stage designers and analysts worked separately, and direct links between solid modeling and FEA were still a distant dream. Things have moved on a lot since then."

As a primary supplier to the automotive industry, Federal-Mogul often works on pistons for engines yet to be fully developed. The fact that the lead time for new engines to go into production has reduced in recent years from around five years to something nearer two has only served to heap more pressure on the design team. Never has the need for efficient and accurate FEA been more apparent.

"When we are tendering for a new contract, we aim to have most of the design and analysis work completed well in advance of any commission," says Dr. Dowley. "This not only serves to satisfy the customer that we fully understand the engineering issues, it also means that we can concentrate on fine-tuning the design if and when work does finally get under way."

IT Where IT's Needed

Federal-Mogul's philosophy has always been to make maximum use of any available technology. "I have never seen the point in qualified engineers spending hours setting up analysis problems when what they should be doing is interpreting the results," adds Dr. Dowley. "So we always aim to use IT to automate anything that does not add value."

The same philosophy applies to the design process. The many years' experience that Federal-Mogul has in designing state-of-the art piston technology is built into every new design. Piston arrangements are defined through a series of parameters that drive the dimensions of a solid model in Pro/Engineer according to design rules that have been perfected over the years. As a result, the basic form of a piston arrangement can be devised in a matter of minutes, freeing as much time as possible for engineers to perform the constructive fine-tuning needed to go forward to the final design.

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-Dr. John Dowley
Design Manager at Federal-Mogul UK

For analysis, Federal-Mogul has been using Abaqus, the leading FE solver, for a number of years. But achieving a direct link between the CAD model and a mesh suitable for an Abaqus analysis is far from trivial. "In Pro/E and Abaqus, I believe we are using the best tools for our parametric modeling and FEA," says Dr. Dowley. "Our working philosophy would break down, however, if models had to be built all over again for meshing."

CADfix Bridges the Gap

Fortunately, Dr. Dowley and his team have found a solution that fits neatly in between modeling and analysis. ITI's CADfix has been developed specifically for handling data exchange between CAD systems and downstream applications – specifically FEA. At Federal-Mogul, CADfix forms a vital bridge between the two tools, and slashes the time needed for design/analysis iteration.

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CADfix's advanced surface handling capability means that complex geometry created within Pro/Engineer can be smoothly transformed into an FE mesh, where a direct attempt at meshing would have yielded unnecessarily complex results. "The ability to prepare a model for meshing is one of the true strengths of CADfix," explains John. "The models we produce in Pro/Engineer tend to be built of a number of connected NURBS surfaces. These would impose false boundaries if meshed directly and cause unnecessary grief. With CADfix, such surfaces can be stitched together into a single representative surface, and there is therefore no danger of discontinuities in the mesh."

A Modern Problem

Federal-Mogul's data exchange experiences are typical of those faced by engineering analysis professionals today. The increased level of solver speed and sophistication and the increased knowledge and expectation of those commissioning FEA are such that it is no longer possible to get away with oversimplifications and qualitative results. In addition, solid modeling technology has advanced so much in the last few years that what were once fearsomely complex models are now considered the norm.

Federal-Mogul's use of CADfix has enabled the design/analyst department to take such advances in its stride. The speed and ease with which complex Pro/Engineer IGES files are transformed into Abaqus-ready meshes means that more possible scenarios can be tried and finer meshes can be used. The end result is that qualified engineers spend their time interpreting analysis results rather than building meshes; ultimately, products are better engineered.

About ITI

ITI is the global leader providing reliable interoperability, validation, and migration solutions for product data and related systems. Our customers recognize the value in having a trusted solution partner that provides more than just software. ITI solves complex product data interoperability problems so that the world's leading manufacturers can focus on making great products. You need to keep your engineering initiatives moving forward.

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