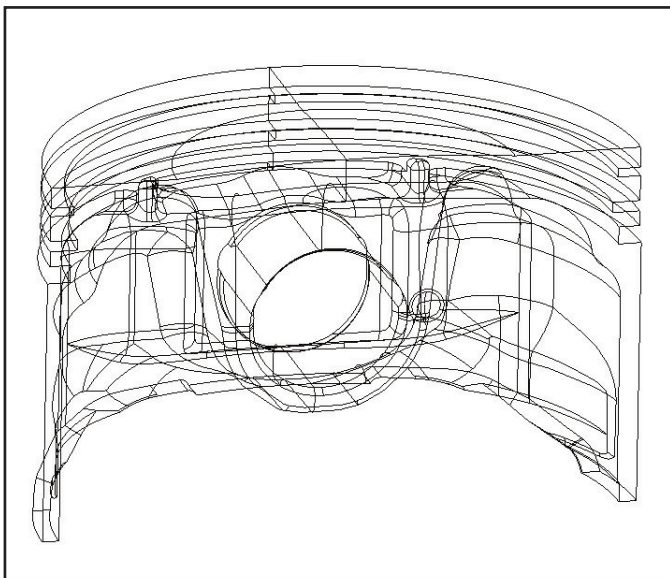




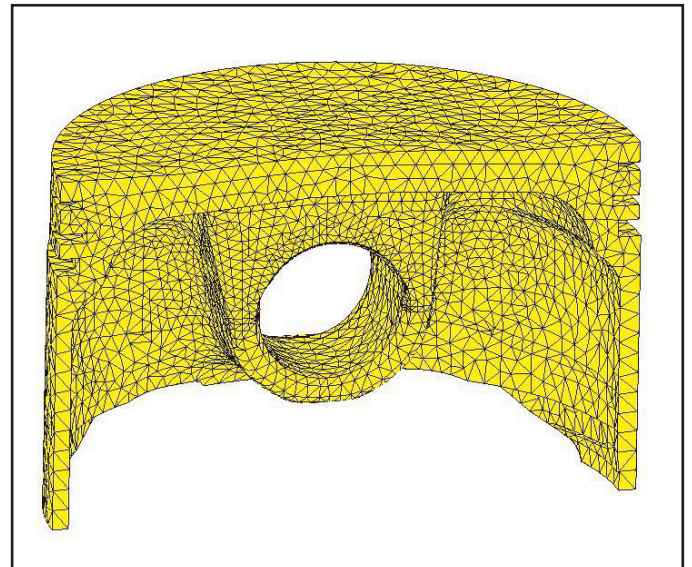
Federal-Mogul pins success on CADfix

Those select organisations faced with the task of supplying components for major automotive manufacturers are increasingly expected to provide far more than just bits of cars. Services like design validation and engineering analysis – traditionally the lot of in-house specialists and third party consultants – are now much more likely to be found in the domain of the first tier supplier. Such additional pressures mean suppliers' design and engineering departments are under a far greater burden and are turning to increasingly sophisticated levels of technology to fulfil 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 some 35 per cent 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, particularly in Europe, the United States and, increasingly, Japan – Federal-Mogul was recently named Nissan's supplier of the year.



Piston head as an IGES wireframe



FEA mesh of piston head

FEA pioneers

Federal-Mogul is as conscious as anyone of the need to be able to provide up-front analysis and validation services. Indeed the design office at the Bradford site – where pistons and piston systems are engineered for the UK, Scandinavia and part of central Europe – 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 modelling 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 more often than not finds itself working 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 even more pressure on the design team. Never has the need for efficient and accurate FEA been more important.

“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 John. “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.”



The finished product

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 John. "So we always aim to use IT to automate anything that does not add value."

The same philosophy applies to the design process itself. The many years experience that Federal-Mogul has had in designing state of the art piston technology is built into every new design that is worked on: there is no point in going back to first principles when you can build on something that has worked perfectly well in the past. Piston arrangements are defined through a series of parameters which drive the dimensions of a solid model in Pro/Engineer according to design rules that have been perfected over the years. This means 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.

And as far as analysis is concerned, Federal-Mogul is a confirmed fan of Abaqus, having been using 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 modelling and FEA," says John. "Our working philosophy would break down, however, if models had to be built all over again for meshing."

CADfix bridges the gap

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

"CADfix provides the perfect path from solid model to FE mesh," says John. "Not only does it provide a good quality mesh for our analysis, it also enables us to maintain vital design information which would be lost with a direct point-to-point translation."

CADfix's advanced surface handling capability also 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. 'Pretty pictures' are no longer good enough. In parallel with this, solid modelling technology has come on in leaps and bounds in the last few years, and what were once fearsomely complex models are now considered the norm.

The presence of CADfix at Federal-Mogul 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 what-if 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 and that – ultimately – products are better engineered.

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