# CADfix®

DuPont Solves Data Interoperability Puzzle

At the cutting edge of polymer research, companies like DuPont are finding more ways of making plastics increasingly prevalent in our lives. As plastics parts are generally lighter and less expensive to manufacture than many 'traditional' materials, it is no surprise that industry jumps at the chance to use polymer-based substances just as soon as such factors as strength and durability have been proven.

As well as supplying a vast range of modern manufacturing materials, DuPont Engineering Polymers offers design consulting service to its customers, assessing both manufacturing feasibility and end-product characteristics. Many customers are 1st and 2nd tier automotive suppliers. In this environment defects in finished components can mean losing a lucrative contract. "Companies like Ford are pushing design responsibility further and further down the supply chain," says Paul Abraham, Engineering Manager at DuPont. "Often they will provide broad specifications and it will be up to the suppliers to come up with the detailed design. This places more burden on us, as we are called upon to make sure the chosen designs are going to work."

Analysis Tools

DuPont has an established set of tools for performing the engineering analysis they need to assess designs. Principally, these are ANSYS for general structural analysis and Moldflow for specialised plastic moulding simulation. In order for these tools to be effective, though, fully defined 3D representations of the proposed designs are a prerequisite, and until recently this generated something of a bottleneck.
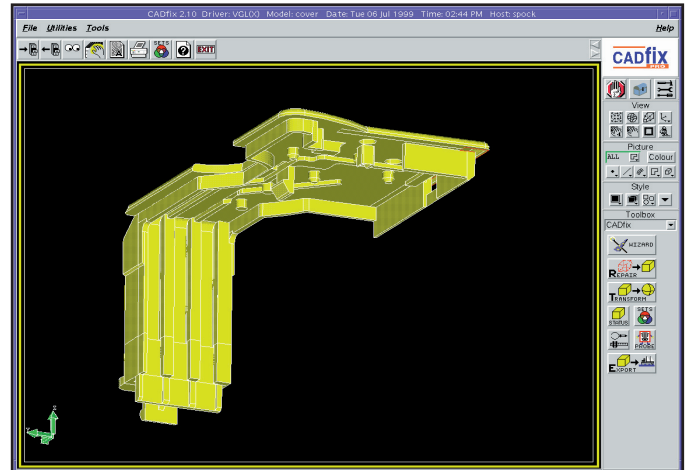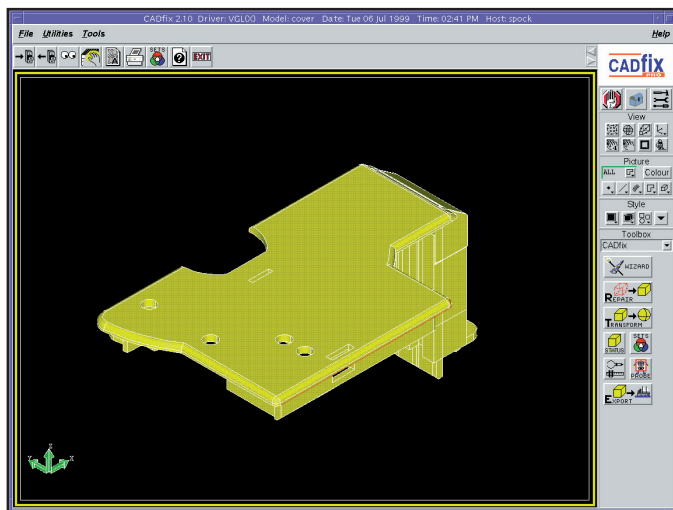
"Three years ago our main communication medium was still the engineering drawing," explains Abraham. "We would manually translate drawings into 3D models in our own CAD system – or sometimes directly in ANSYS – and move on to meshing and solving from there. Not perhaps an ideal system – but one that worked well."

The past couple of years, however, have seen an explosion in desktop solid modelling, and with it an increase in the inherent complexity of computer-aided designs. Now designers are unwilling – or unable – to translate their efforts into engineering drawings and the modem is fast becoming DuPont's primary tool for the communication of design intent.

Data Limitations

But placing such emphasis on 3D models quickly uncovers some severe limitations in data communication. Even with a relatively modest number of modelling kernels there is still a wide range of proprietary formats in use across the solid modelling market, each of which has its own quirks and peculiarities. Even 'standard' file formats such as IGES are causing problems. Because IGES (and other specifications) are handled so differently at import and export by each CAD/CAM/CAE tool that relying on IGES alone is a recipe for disaster.

With few sensible alternatives around, however, DuPont has been plugging away with IGES for some time. Typically this has required significant re-working of 3D data to isolate and correct errors and inconsistencies following the IGES import. ANSYS does have its own IGES translator, but because of the wide range of possible sources of native data – each with its own standards for tolerances – it was extremely rare for a solid model to come in complete and correct first time, and not uncommon for it to fail altogether. All too often it would be back to the drawing board – or in this case back to the solid modeller – remodelling components from scratch. And without the reassurance of engineering drawings to fall back on, this hardly represented progress.

Bridging the Gap

Fortunately, DuPont has found a way of reusing CAD data without costly and time-consuming remodelling. "When we saw CADfix we knew immediately that it was exactly what we had been missing," said Abraham. CADfix has powerful tools for assessing geometric and topological imperfections in solid models and making corrections to cure them. Much of the time this can be performed automatically, but users tend to step through the corrections interactively: an initial analysis highlights graphically which surfaces are incorrectly connected and need further attention, and merges any duplicated points, edges, surfaces and faces. The user can then step through the detected imperfections and chose a method for curing them, typically closing a loop or fusing edges that lie within a specified tolerance. The end result is a fully formed, closed solid model which can be taken to a downstream application – in DuPont's case a finite element analysis (FEA) package.

Flexibility and Productivity

"With CADfix we have managed to eliminate any in-house solid modelling altogether," explained Abraham. "We can now confidently take IGES files from any CAD system and process them in CADfix before going straight to analysis. As a result we are working with a truer representation of the proposed design and we can therefore perform more accurate analysis."

The real benefit, though, is in time saving. Abraham estimates that, on average, the previous way of working – often involving complete remodelling of parts – involved as much as three times more work for each component. "I would estimate that in about 95 per cent of cases we can make a good solid model in a short time with CADfix," he says. "This greatly increases our analysis capacity and therefore boosts the service we can offer our customers. Analysis is effectively completed far quicker, we can perform more design iterations and the end-products are better engineered as a result."

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