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TECHNOLOGY FOR THE PRODUCT LIFECYCLE

SIEMENS PLM SOFTWARE NX SUPPLEMENT

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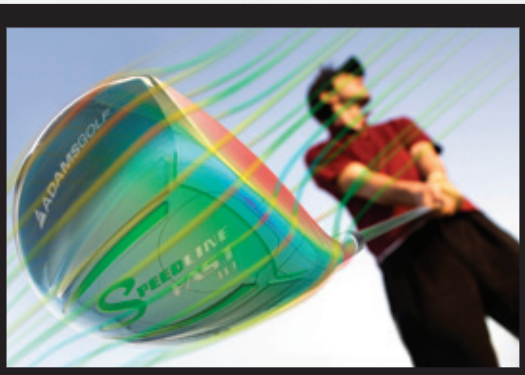
THE NX FAMILY

DESIGN, SIMULATION AND MANUFACTURING IN PERFECT HARMONY

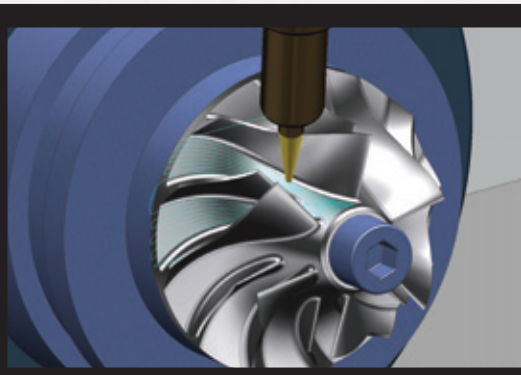
CLARITY WITH HD-PLM

MAKING PLM DATA VISIBLE ACROSS THE ENTERPRISE



THE FOUR TENETS OF SIMULATION

REVOLUTIONISING ANALYSIS WITH NX SIMULATION



MANUFACTURING ENGINEERING

BENEFITS OF AN INTEGRATED APPROACH WITH NX

NX 7 – Redefining product development productivity

NX 7 software – combining high definition decision making with world beating CAD/CAM/CAE to redefine product development productivity

CAD design productivity

- High definition 3D (HD3D) technology
- Powerful design acceleration tools

CAE productivity

- New analysis technology for modelling, simulation, automation and test correlation

Manufacturing productivity

- Turbomachinery milling for programming complex blisks and impellers
- NX CMM inspection programming for working with PMI model data

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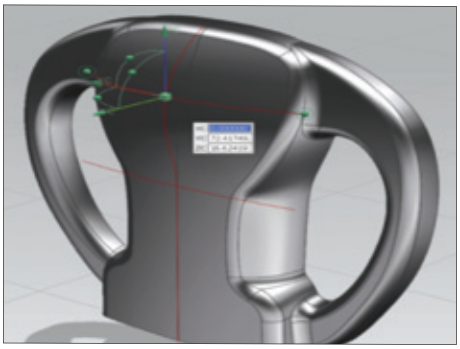
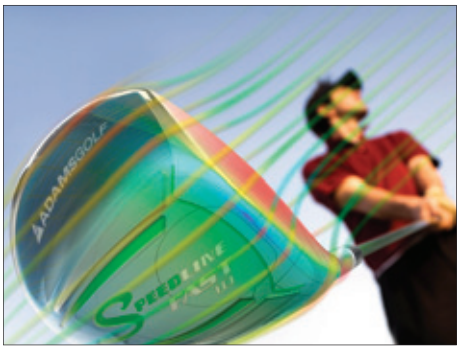
CONTENTS

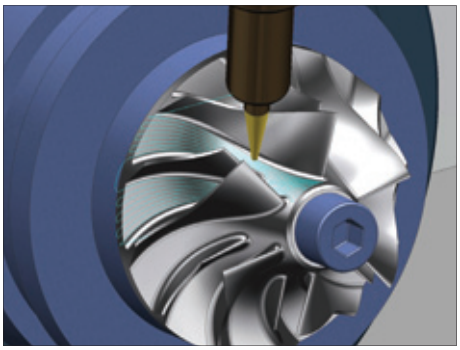
NX DESIGN - page 4



NX SIMULATION - page 11



NX MANUFACTURING - page 18



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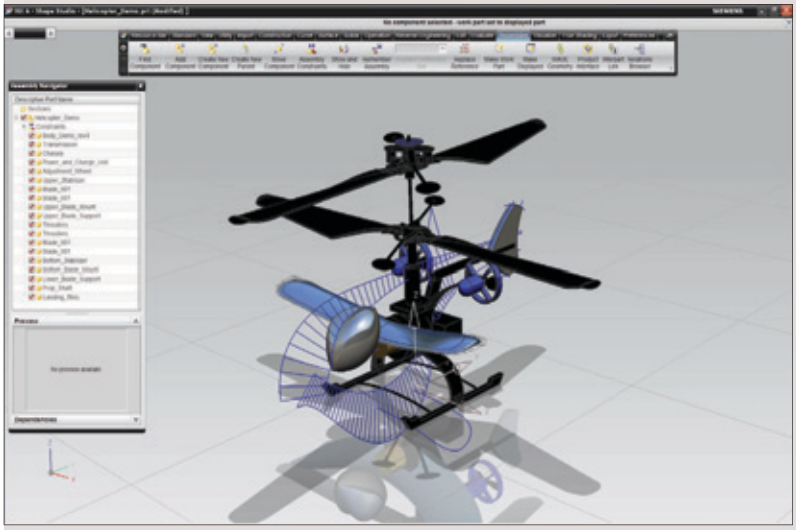
FREEDOM WITH SYNC TECHNOLOGY

SYNCHRONOUS TECHNOLOGY IN NX OFFERS A WHOLE NEW WAY OF MODELLING. WE TAKE A CLOSER LOOK AT THE TECHNOLOGY AND SHARE OUR TOP FIVE OPERATIONS WHICH WILL HELP MAKE FREEFORM MODELLING WORK TO YOUR ADVANTAGE



Helicopter assembly modelled in NX using Synchronous Technology

Synchronous Technology is at the heart of NX 7.5 and allows the manipulation of geometry without the burden of a history tree, which is typically used in 3D model construction. By combining a set of direct modelling operations with dynamic rules and filters, it allows modifications to be made directly to the geometry without having to rollback or edit the feature history. Faces can simply be grabbed, pushed, pulled and rotated into place, offering a much more freeform method of modelling.

While this functionality is typical of all 'direct modelling' technologies, Synchronous Technology has additional benefits. It can interrogate the geometry surrounding a face (or faces) and identify inferred relationships, such as concentricity, tangency or parallelism. These 'Live Rules' are highly configurable so intelligent edits can be created inside a model. Most importantly, all of this is done without getting in the way of the process - the user simply grabs the geometry and then makes edits once the system has identified any relations. There's no recalculation and no regeneration and it works with both native NX and imported geometry.

HISTORY VERSUS NON-HISTORY

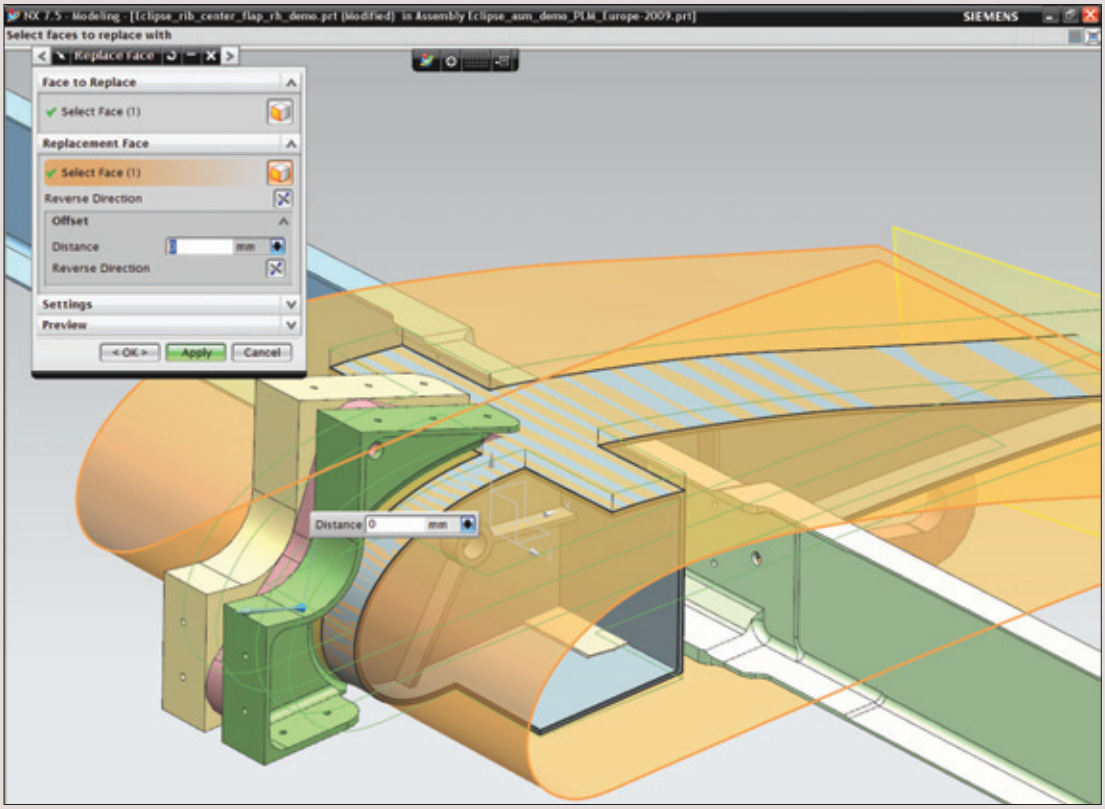
With a traditional history-based approach, features are created and edited in a linear manner and the resulting models are highly structured. With a Sync Tech approach freeform modelling tools are used to create and edit a model without storing a construction history. Constraints can be added and parametric relationships created, but almost everything is done dynamically and on-the-fly.

Acknowledging that users like to work in different ways, history can also be switched on and off at will inside NX. Users can chose to work entirely with history, entirely with Sync Tech, or a combination of the two. All three approaches have their merits and suit different workflows and users.

Broadly speaking, a history-based approach is particularly useful when parts need to be parameterised. It also has the added benefit of being familiar to most 3D CAD users. A Sync Tech approach would particularly suit those working with imported geometry or those who just want maximum editability in their model. A hybrid approach, using both history and Sync Tech, would suit models where a part history is too complex to dig in and make localised edits early on in the history. It offers the flexibility of modelling using Sync Tech, but features are appended onto the end of the history tree, so are still formalised and traceable.

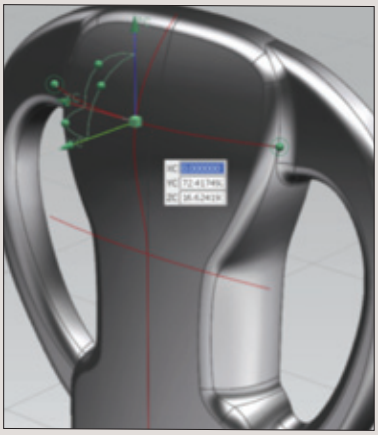
It's likely that most users will use a combination of all three approaches to suit different forms and requirements on a per part basis. The point is that it offers maximum flexibility and users aren't constrained by the modelling tool to get to the end result. It's a very powerful and well thought out technology.

TOP 5 SYNC TECH FEATURES



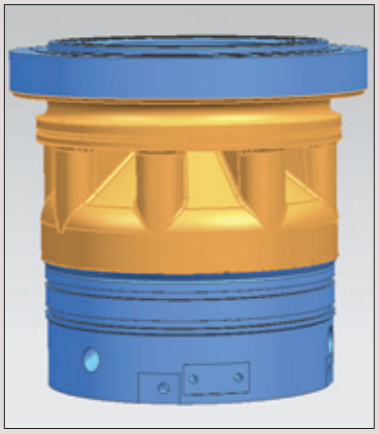
1 REPLACE FACE

Introduced in NX 7.0 and greatly enhanced in the NX 7.5 release, this operation's name belies its power. It allows users to edit faces and replace them in the context of a part (either using new geometry or matching to existing forms). In addition it can take part geometry into an assembly and along with the Live Rules match it to new positions or references from other parts. It'll also work a treat on imported data



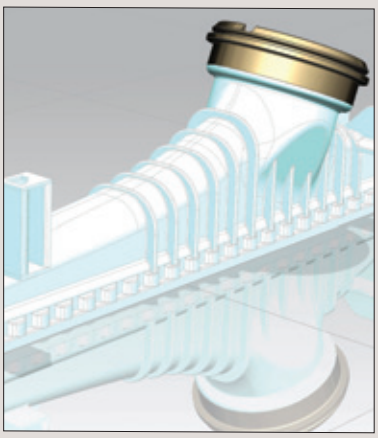
2 IFORM

NX 7.5 has introduced a number of tools targeting the editing of non-prismatic features. In particular, the new iForm tool allows users to edit surfaces in a dynamic free-form manner, while maintaining all of those relationships that build part form (such as tangentially connected faces)



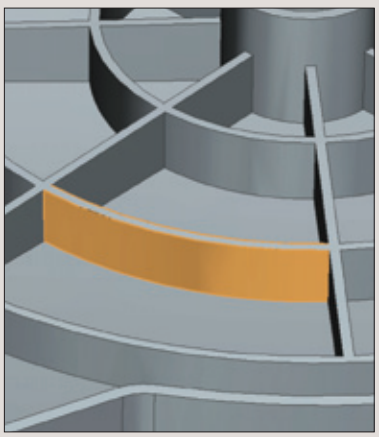
3 RE-BLEND AND RE-CHAMFER

This one is key for users working with imported geometry. It will take both blends and chamfers and replace them with intelligent features (i.e. it will replace B-surface faces that represent blends/fillets with NX rolling ball blends). This pays dividends in both design changes and downstream when de-featuring for CAE purposes



4 FIXING AND LOCKING

Within NX 7.5 users can lock faces and create a fixed 3D constraint. When working with freeform modelling techniques, it's often the case that they know what they want to move and what they want to remain in position. Both of these techniques allow them to do just that and then make the required edits

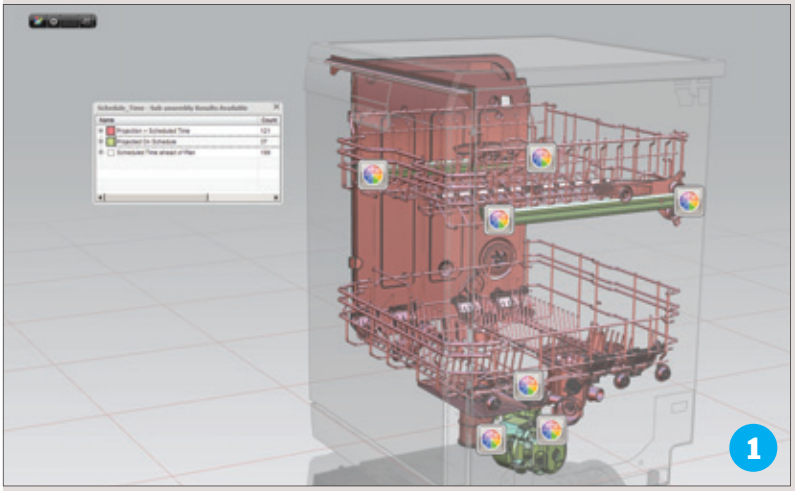


5 WORKING WITH THIN WALLS

NX excels at plastic part design but, in a freeform workflow, components of uniform thickness can cause headaches as faces can be moved which remove that uniformity. The new Find Offset and Edit Thickness commands can be used to work with these forms intelligently to either manipulate matching pairs of faces simultaneously or to edit wall thickness where needed

HD-PLM: CLARITY OVER COMPLEXITY

ORIGINALLY LAUNCHED LAST YEAR, HD3D NOW INTEGRATES DIRECTLY WITH TEAMCENTER AND HELPS BRING CLARITY TO COMPLEX AND HIDDEN PLM DATA, EXPOSING IT TO EVERYONE INVOLVED IN THE PRODUCT DEVELOPMENT PROCESS



1 Components have been organised in relation to the project timeline. Those shown in green are 'on schedule' while those in red are projected to overrun deadlines. This means resources can quickly be reallocated to solve bottlenecks and bring the project back on track

With consumers continually demanding more functionality, more capability and more sophistication from their products, the processes that surround their development have also become increasingly complex. Charting the exact point where a product is in the development process has become a major challenge for manufacturers of consumer products. Managing the status of supply chains and outsourced teams is par for the course but the problem is compounded by the fact that most product development information is held in text form, made available only through complex search and retrieve techniques.

It is against this backdrop that Siemens PLM has developed High Definition 3D (or HD3D for short). Combining elements of Teamcenter, its enterprise class data management solution, and JT, its popular lightweight data visualisation format, HD3D is able to present data locked in a data management system in a highly dynamic and graphical way. Taking metadata as the starting point it uses colour coding, tagging and other methods to present product data clearly and unambiguously.

HD3D was launched last year and the first incarnation extracted metadata directly from the NX 3D CAD model. Now in line with the NX 7.5 release the technology also integrates with Teamcenter and this opens up its visualisation and interrogation capabilities to everyone involved in the product development process. This significant new development delivers on the HD-PLM framework and it is available in two core areas: Visual Reporting and Check Mate, which we'll look at in turn.

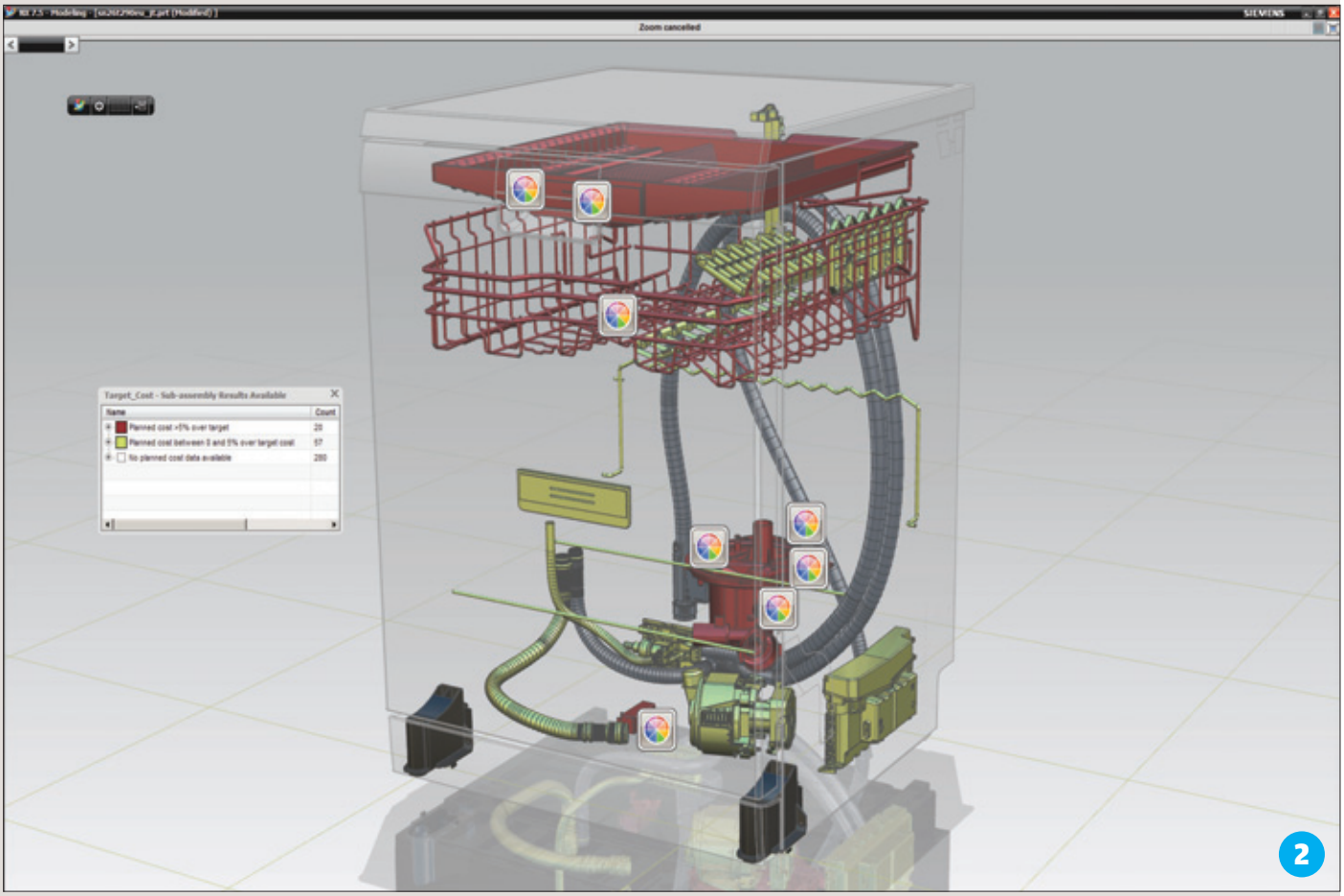
VISUAL REPORTING

Data management systems excel in many areas but in essence there are three things they control: access to product data, change, and the status of product data. With complex products, however, it's very difficult to track their progress as the various elements move through the product development process. In running a text string search to identify which particular parts or sub-assemblies are in progress, outsourced or released, the system will present its findings in another text-based list. The problem is, this doesn't tell the average person a great deal and this is where Visual Reporting comes into play.

Starting with a simple dialog box, the user can set-up initial criteria on which to search or quantify assembly data. This could be very explicit, such as identifying sub-assemblies over a specific weight or size, or based on a fuzzy logic search such as 'all parts that contain the word cowl'. The system will then present the results data in a list form, but also colour code the resultant geometry in the 3D display window, greying out all the other components.

Searches with multiple responses can also be carried out. For example, the system can colour code parts according to specific suppliers, giving each a unique colour. Search and visualise criteria can also be combined to add more detail. For example, supplier parts, over a specified size.

Visual reports can be formalised and distributed across a



team, enabling decisions to be made on the basis of very rich data. For example, consider a sourcing team looking at a new product concept. In today's economic climate, costs need to be stripped back, while maintaining product quality. Visual reporting can be used to break down the costs within a single product, highlighting which components or sub-systems are over budget and where costs are stacking up. Most importantly, this information is presented in a clear, unambiguous way allowing anyone to look at them in context and make informed decisions, quicker.

STANDARDS & VALIDATION WITH CHECK MATE

While the ad hoc approach of Visual Reporting provides a powerful way of gaining insight into a product and its development status, HD3D can also be used in a much more structured way. For many years, NX and Teamcenter have included a tool called Check Mate. This allows an organisation to standardise how digital information is created within its design and manufacturing teams and ensure that all data adheres to set criteria before being placed in the Teamcenter environment.

The use of Check Mate can be varied, ranging from formalising geometry quality in terms of modelling best practices to helping ensure drawing data (both 2D and 3D using PMI-based methodologies) is created to International and industry sector standards or internal and supply chain requirements. Another example would be to help ensure that critical components have all had the required simulation processes carried out upon them.

All of this can now be visualised using HD-PLM technologies. By creating the Check Mate reports, an assembly can be loaded up and the system can display which components have not yet had simulation tests carried out on them, then kick off a workflow to distribute that work package to the appropriate team member.

CONCLUSION

Managing the development of complex products is a continual challenge for most design and manufacturing firms. HD3D brings visual clarity to this difficult process offering tools to help track the status of a product all the way to final release. With clear visual feedback users of all technical ability can make informed decisions to help bring down cost and speed time to market.

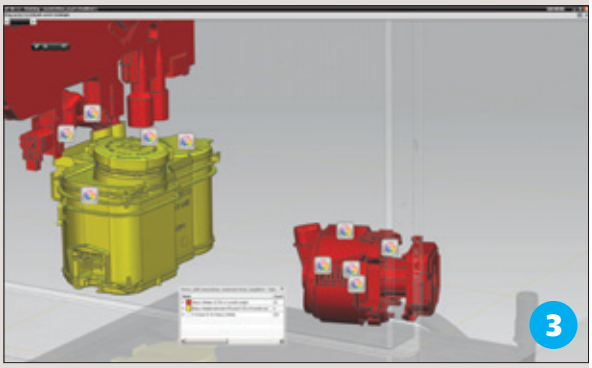
It may not be the most headline-grabbing feature of Siemens PLM's new suite, but when compared to the traditional list-based approach of data management it has the potential to make a huge impact on the efficiency of the product development process.

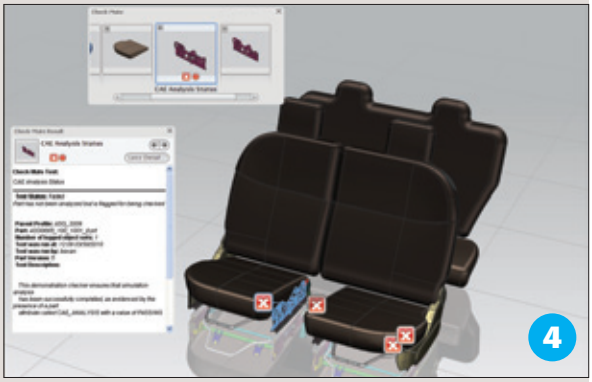
tinyurl.com/HDPLM

2 Cost Stack up: This shows a Visual Report which categorises parts and sub-systems by budget factors. Those areas shown in red are already more than 5% over planned budget, while those in yellow are between 0% and 5% over budget. This allows the team to identify where potential savings can be made and where focus of effort should be placed

3 Compliance is on the minds of many organisations. This shows components within the product that contain SHVCs, categorised by % of weight. This data is pulled from Teamcenter and presented visually

4 A CAE check run on the structural components in a seat assembly. The system has identified components that have failed checks. These can be inspected in detail





BRINGING INTELLIGENCE TO 2D DESIGN

NX DRAFTINGPLUS BRINGS NEW LIFE TO THE WORLD OF 2D DESIGN AND THROUGH A COMBINATION OF INTELLIGENT TOOLS AND TIGHT INTEGRATION WITH TEAMCENTER MAKES THIS ESSENTIAL PROCESS BECOME AN INTEGRAL, MANAGED PART OF PRODUCT DEVELOPMENT

While the majority of CAD vendors have been banging the 3D drum for decades now, many organisations involved in product development still use a mixture of 3D modelling and 2D drawings. To put this in perspective a recent report by Robert Green of cad-manager.com stated that, in the manufacturing and mechanical design industries, only 9% of organisations were working purely in three dimensions, with a similar number working only in 2D. The vast majority of organisations are using a hybrid 2D/3D approach or are currently working in 2D and bringing 3D on-stream.

From model intelligence to downstream applications such as CAM and simulation, the benefits of 3D are manifold but, for many companies, 2D remains essential when documenting, annotating and communicating products during their development. Some companies also find that 2D is more adept at certain tasks - whether that's for a basic layout sketch for planning or simple clarity of thought when scheming or sketching out an idea.

INTRODUCING NX DRAFTINGPLUS

Siemens PLM Software has always offered an integrated approach to drawing creation and documentation inside NX. The established workflow is to take a 3D product model and bring it into a drawing environment to generate orthographic views and add annotations. As each drawing view is intelligently linked to the 3D model, any subsequent changes made in 3D can be propagated quickly.

NX DraftingPlus is an extension to the standard drawing creation and annotation tools in NX. It provides all the same functionality and workflow as the core NX drafting tool, but also adds a set of automated and intelligent tools to assist with 2D centric workflows.

A good example is the 'Project to View' operation. This allows the user to take geometry from an initial orthographic view and project it into associated views, saving lots of time. The software also features Copyto3D, a tool that helps users explore new concepts and ideas in 2D and then move into the 3D world when ready.

NX DraftingPlus is fully integrated in NX so uses the same roles-based fully customisable interface as NX. This allows users to tailor working environments to individual needs. Because it is an integrated solution users have access to the full set of drawing annotation and documentation tools required to fully detail manufacturing drawings - whether based on International, industry or internal standards.

MANAGING 2D PROCESSES

The early stages of design are typically fluid and unstructured, where ideas are explored or products schemed out in sketches. The problem is a great deal of intellectual property is contained in those formative stages. NX DraftingPlus takes advantage of the NX data format so it can be used inside a Teamcenter-based data management backbone, allowing users to not only store, manage and control drawings as a product moves towards production, but also to enable early concepts and sketches to become an integral part of the history of a project as things start to formalise.

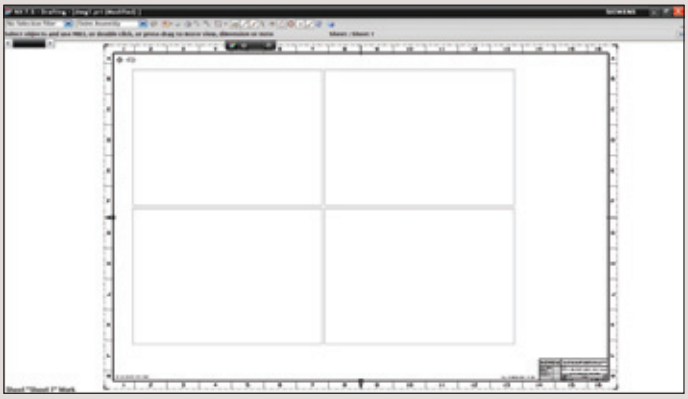
THE SINGLE SOURCE ADVANTAGE

Despite the rise of 3D, the product development process is not always as simple as 'model in 3D, produce drawings in 2D'. In many companies, 2D and 3D processes often run in parallel. NX DraftingPlus provides the tools needed to support 2D centric workflows, but as the technology is based on the drafting engine from NX it offers the benefit of having all data in the same native format, accessible and workable without translation. Maintaining independent 2D and 3D systems can have a high cost of ownership. Data translation can be time consuming, hard to manage and can sometimes result in loss of data or accuracy. It can also provide a challenge when it comes to training and staffing.

NX DraftingPlus is also available through a cost effective and fully functional standalone bundle called NX Power Drafting. This can be used for documenting drawings using 3D solid models and assemblies created in NX or as a standalone high-performance 2D design and drawing system.

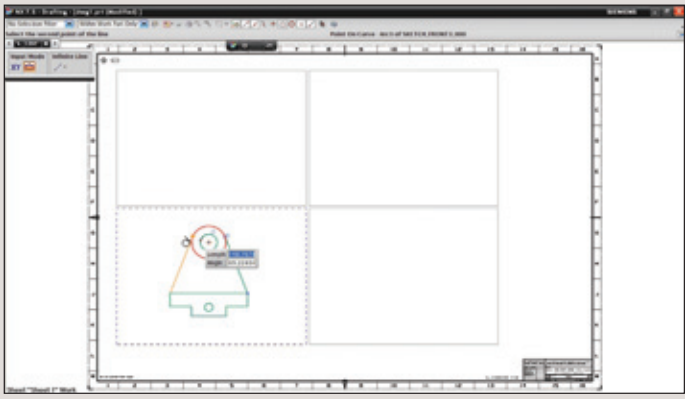
2D TO 3D WORKFLOW WITH NX DRAFTINGPLUS

1 START WITH BLANK SLATE



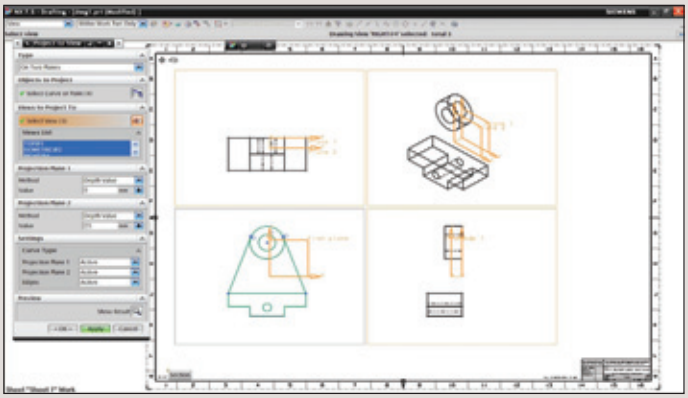
Start with a blank drawing with four completely empty drawing views

2 DRAFT ELEVATION



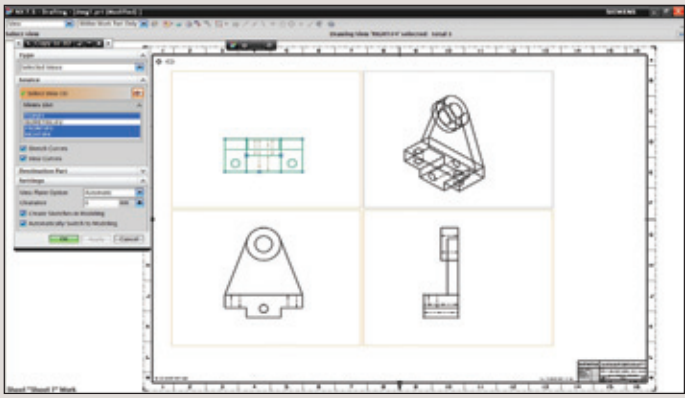
Use the intelligent drafting tools to complete a sketch in one of the views

3 PROJECT VIEWS



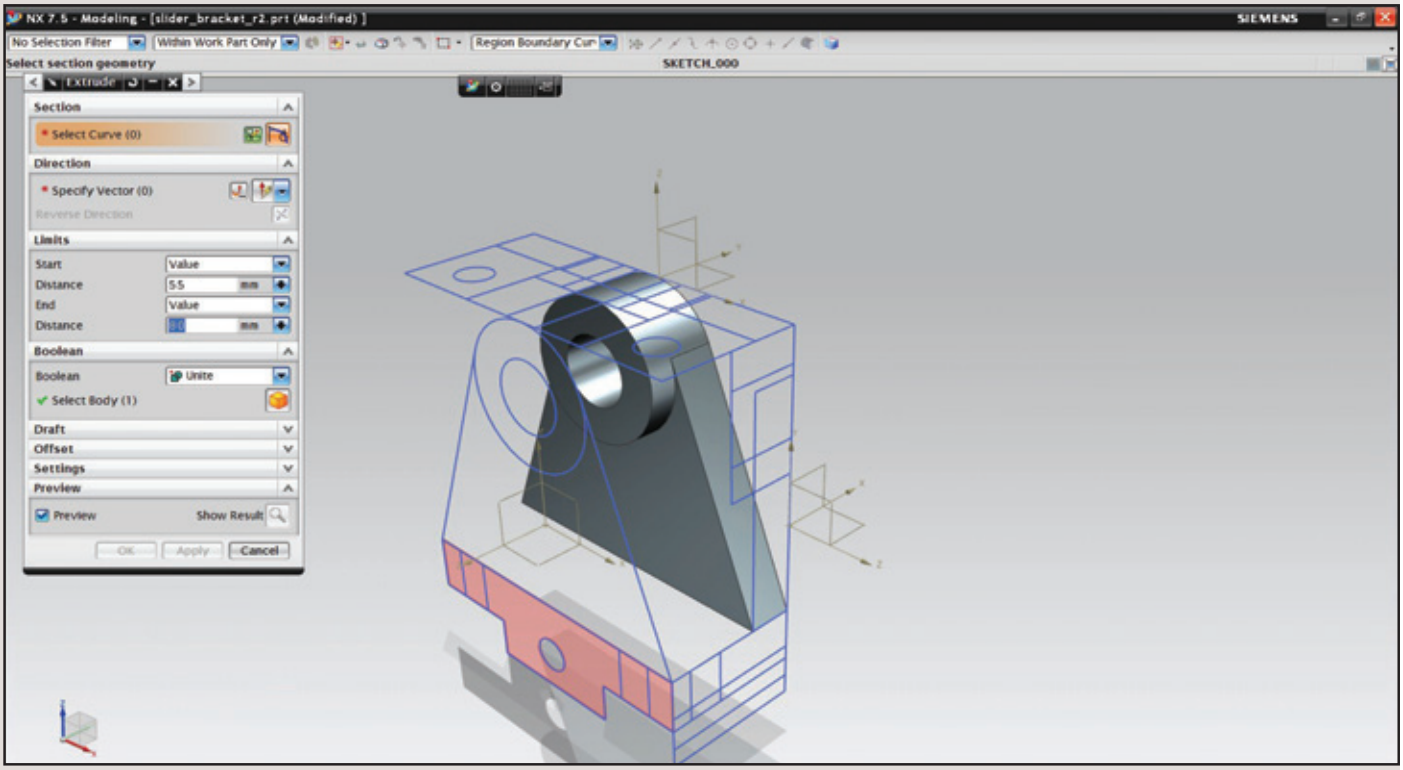
Use the Project to View command to build up orthographic / isometric views

4 COPY TO 3D



Use the Copy to 3D tool to select source views and build the 3D model

5 FORM 3D SOLID MODEL



Sketches from the drawing are oriented in the 3D Space and the solid model is formed, ready for use in the NX environment and beyond

FROM DESIGN TO INDUSTRIAL PRODUCTION

NX FROM SIEMENS PLM SOFTWARE HAS HELPED A LEADING FRENCH INDUSTRIAL AND MECHANICAL DESIGN COMPANY OPTIMISE ITS CREATIVITY, FROM THE POINT OF DEFINING A PRODUCT'S SPECIFICATIONS ALL THE WAY THROUGH TO PRODUCTION

From product vision and market evaluation to design and process development, French ID and mechanical design firm KeyOx touches all corners of product development. Based in Gillonay, France, the consultancy serves companies of all sizes in industries such as electronics, sports equipment, industrial components, special machinery and technical products. Its key clients include: Coval, Salomon, Parker Hannifin, Raisonance, Eliot and ST Microelectronics.

In 2005 the company's two founders, Paul Laurens and Mathias Allély, engineer and industrial designer respectively, observed that problems encountered throughout product development are generally linked to a lack of industrial vision at the outset of the innovation process.

Drawing on years of experience this observation was also backed up by a number of statistics. First, 78 percent of manufacturing companies believe that the longevity of their firm depends on innovation. Innovative companies reap 73 percent higher profits, and 70 percent of new product launches are failures because they do not correspond to the expectations of the market. As hindrances to innovation, companies cite the difficulty of anticipating customers' needs (59 percent) and internal resistance to change (47 percent).

Laurens and Allély can give full scope to their idea, which is to offer their clients pragmatic product development in close cooperation with internal teams. Freed from the linear progression from one task to the next that other firms typically follow, KeyOx can focus on what is essential: the overall success of the project. In short, it offers a method that allows innovative, high-performing products to reach the market faster.

As design and CAD professionals, Laurens and Allély know the software market well. In choosing a CAD solution for their firm, they visited the main suppliers, then supplemented these trips with thorough product evaluations. Their main requirement was a complete tool that was sufficiently robust and industrial to adapt to all needs and all phases of the product development process. In short, they wanted a solution for managing the lifecycle of the product.

This ruled out solutions that focused on certain aspects of the process but not on the entire chain of development, hence limiting opportunities for collaborative work.

"We were really looking for a magic toolkit that would allow us not only to set up our methodology, but also to adapt ourselves to all the demands of our clients at all stages of product development," explains Allély,

KeyOx chose the NX design solution from Siemens PLM Software as it allowed its team to capitalize on its knowledge of the development process as well as its expertise in design. It was also shown to comprehensively support industrial design, which was a key consideration for the company. "We have no limitation on shape, which is vital to a designer," explains Allély. "We are not forced to adapt our design to the tool."

With NX the KeyOx team can create virtual prototypes very early in the development of the product. "This suits our approach perfectly," adds Allély. "We can visualise what the final product could be and have it validated by all the groups involved in the development process, from marketing to manufacturing and including the design office. And everybody knows that a picture is worth a thousand words."

The product concept serves as the starting file that becomes the basis for the rest of the development work. It integrates all information, both that of KeyOx and of its clients. Generally this information is collected using the STEP neutral exchange format, which allows improvements and changes as well as the import of new data. The file evolves gradually as it advances through the various stages of the process.

"NX is both robust and industrial, allowing us to make all modifications very quickly, no matter what stage the process is in," adds Allély. "As an example, there was a client for whom we carried out the design of a remote control system. We had finalised the mechanical design and were in the process of defining the ribs around the screws when they noticed an error in the specifications, a problem of battery size. Thanks to the parametric and associative modelling of NX, we immediately modified our base model by changing two curves. No time was lost."

Another strength, according to KeyOx, is fast training. "NX is a straightforward tool, even for the non-initiated," explains Allély. "We had never used it before and we were able to bring out our first project only a month and a half after receiving the solution."

The NX integrated CAD solution is now the backbone of the company's strategy. The parallel approach that is KeyOx's credo is made possible thanks to this tool. The project manager's work is made even easier by the fact that the teams, internal and external, work in complete collaboration from a master file that constantly evolves. Thus everyone contributes to the innovation process. Results have already been felt: a 50-percent saving of time required for product development. This is a significant benefit in time required to reach the market and it is accomplished without neglecting the quality and cost aspects of the products.

www.keyox.com

1 The ST7Ultralite Primer, a low cost in-circuit debugger and programmer from Raisonance that enables users to run, modify, and debug application code on a host PC

2 The Raisonance ProxiSPY a protocol analyzer for capture and analysis of communication between contactless cards, readers and mobile handsets

3 KeyOx mechanical cleaning machine

THE FOUR TENETS OF SIMULATION

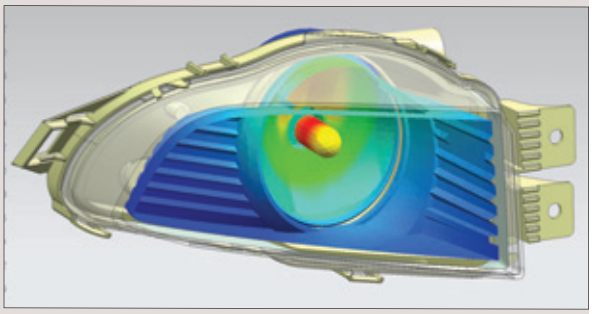
SIEMENS PLM SOFTWARE HAS A COMPREHENSIVE SUITE OF COMPUTER AIDED ENGINEERING (CAE) SOFTWARE. WE LOOK AT THE FOUR CORNERSTONES OF SIMULATION THAT FORM THE FOUNDATION FOR ITS POWERFUL NX SIMULATION OFFERING

Since the merger of Unigraphics Solutions and SDRC nearly eight years ago, the NX product has been the flagship offering from Siemens PLM Software. The union brought together expertise in geometry creation, manufacturing knowledge and know-how in CAM, deep simulation (CAE) knowledge as well as data management with Teamcenter. One area that has advanced the most is analysis and here Siemens PLM created a suite of NX Simulation software. This revolutionised analysis in NX, offering a huge raft of tools and technologies to help understand the behaviour of a wide range of products.

In developing these next generation simulation tools, Siemens PLM Software identified four cornerstones of Computer Aided Engineering (CAE) which would be built into its technology: those of integration, multi-disciplines, analysis & test correlation and openness. Let's take a closer look at exactly what each of these means.

> "NX SIMULATION REVOLUTIONISED ANALYSIS IN NX, OFFERING A HUGE RAFT OF TOOLS AND TECHNOLOGIES TO HELP UNDERSTAND THE BEHAVIOUR OF A WIDE RANGE OF PRODUCTS"

1 INTEGRATION

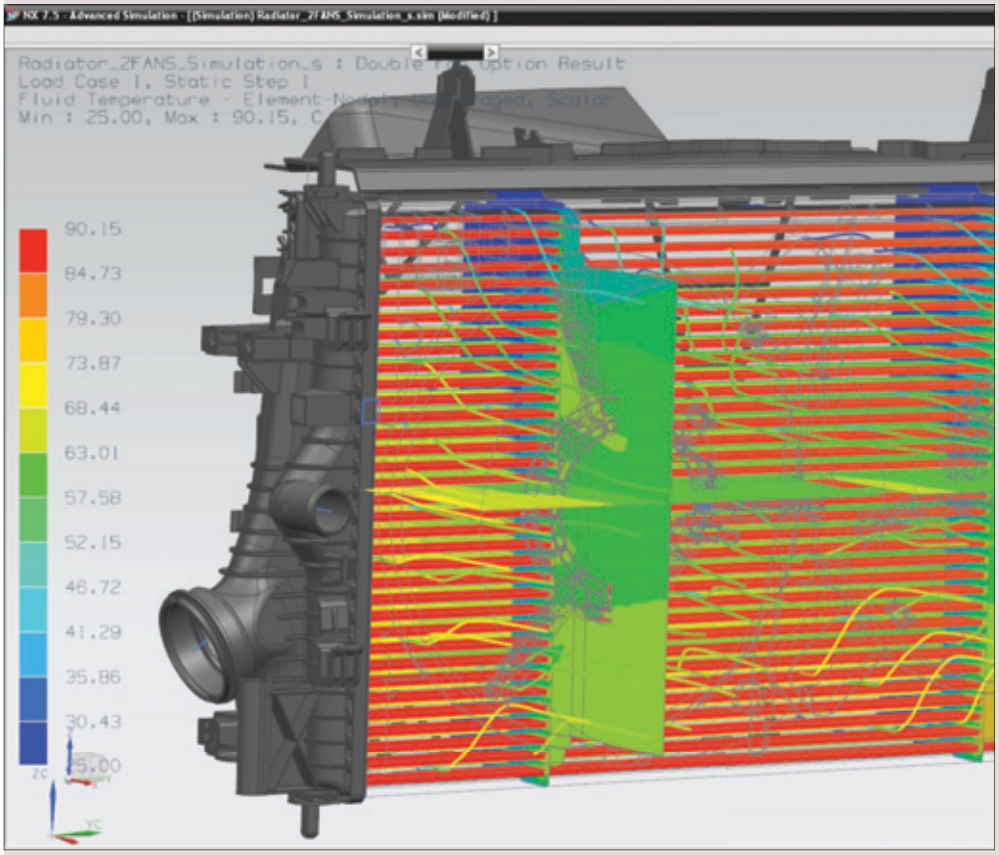


It is no longer acceptable to have experts working independently, creating geometry from scratch and conducting arcane FEA simulations on abstract geometry. If product development is to be accelerated and the goal of better, cheaper and more efficient products is to be reached, then something different is required.

NX provides a range of tools for product simulation that integrate directly into the product development platform. These range from the Stress and Vibration wizard-based tools delivered with every NX license, through to the more advanced NX Simulation tools that bring static, modal and thermal analyses directly to the NX interface.

This integrated approach means that many firms use NX as their core platform for both Design and Simulation, a prime example being the Acura division of Honda. Looking to replace a heavy magnesium gearbox casting with a thin walled aluminium structure for its Le Mans prototype, the Acura design team was able to create and update new design iterations with over 4,000 features in under 30 minutes. Once done, a single team member can evaluate its performance in under three hours and feed the results directly back into the design workflow - a process that would previously have taken ten days.

2 MULTI-DISCIPLINES



The simulation world has historically been split into several disciplines. Finite Element Analysis (FEA) deals with structural and modal performance and behaviour. Computational Fluid Dynamics (CFD) deals with both fluid flow and heat transfer. Motion Simulation deals with assemblies in motion and fatigue studies a product's performance with respect to time.

Traditionally, each of these simulation processes have been conducted in isolation, but the introduction of multiple disciplines is changing this by creating an environment in which the results and findings from each can influence the others.

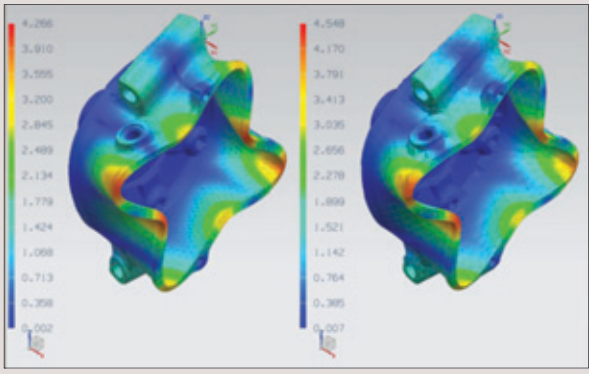
One customer already taking advantage of NX's multi-disciplinary capabilities is Keyria, a leader in turnkey solutions for building materials. The company makes huge machines that produce building materials such as bricks, concrete blocks, moulded plaster, many of which require automation in very high temperature conditions. Keyria's team uses NX Nastran, NX Thermal, and NX Flow products to assist with simulating its products. The team managed to cut the research and development cycle for a brand new 'force air' industrial oven system from one year to two months and through the use of comprehensive simulation also managed to deliver some pretty dramatic energy savings in the system.

3 ANALYSIS & TEST CORRELATION

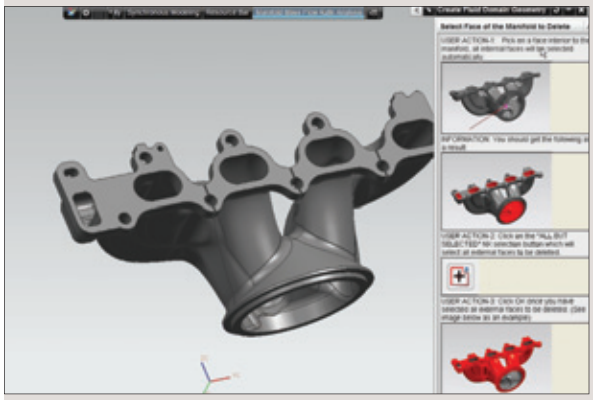
While many CAE software vendors espouse the digitalisation of test, the facts are that physical testing is a way of life and is going to remain so for the foreseeable future. With that in mind, it's important to be able to form a synergy between digital simulation and physical testing.

Can simulation be used to assist with preparing physical test rigs, to optimise them and fine-tune them to achieve the most accurate results possible? And can physical test results be used to add confidence that digital simulation work is accurate and matches physical, real-world results?

NX delivers its analysis and test correlation tools in two key modules - FE Model Correlation and FE Model Updating. FE Model Correlation supports the pre-test planning process, and offers import/export of data plus tools to compare physical and digital tests side by side. The pre-test planning is key, as the digital simulations can be used to conduct modal analyses, which can then be used to position sensors exactly where they're needed, rather than using guess work. Meanwhile, FE Model Updating allows digital simulation models to be updated to ensure that they match real life test data.



4 OPENNESS

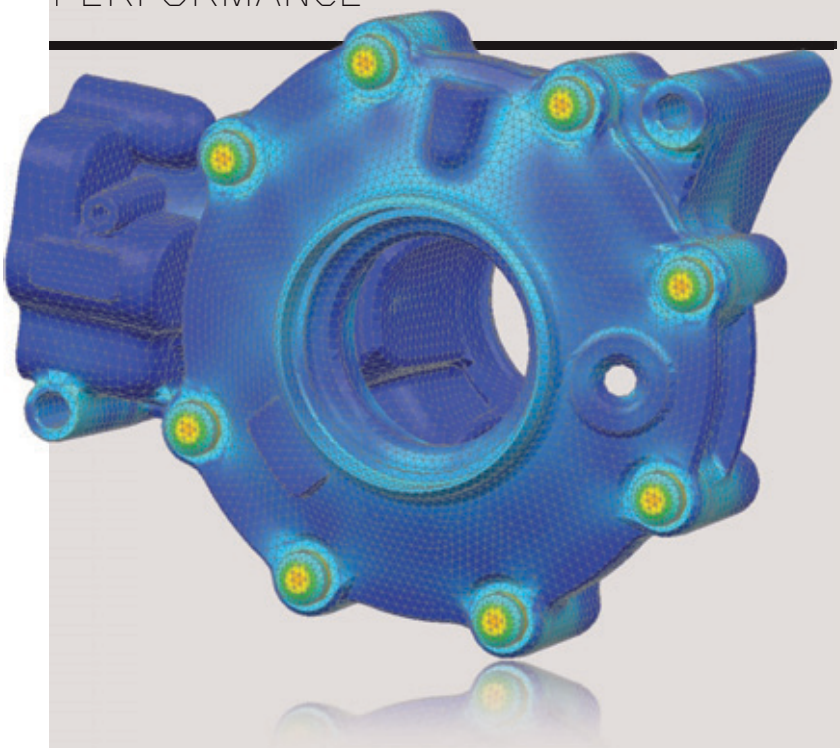


In the world of simulation openness is the key to providing an environment in which standard software solutions can be customised and automated and integrated with increasingly common in-house applications.

Siemens PLM Software has a reputation for openness, from its licensing of the Parasolid and D-Cubed engines used in many of today's leading applications, through to the establishment of processes, workflows and best practices using the JT format. Within the Simulation space, NX Open provides an environment in which organisations can use standard programming technologies (.NET, C++) as well as journalling capabilities (think: Macros) to get users up to speed as quickly as possible. To explore things a little further, the Knowledge Fusion environment was introduced into NX's predecessor some time ago and has become the foundation for automation and customisation within NX. Using this along with more recent developments, such as the Product Template Studio, allows users to capture best practices not only in terms of simulation, but in terms of many other areas of the system (modelling, manufacturing etc). Here, easy-to-use tools can be created that store and formalise expertise and knowledge and these can then be distributed to non-specialist users.

AN INTEGRATED APPROACH TO SIMULATION

SIMULATION IS APPROPRIATE TO BOTH THE EXPERT USER AND THE AVERAGE DESIGNER AND ENGINEER. WITH A SINGLE COMMON PLATFORM, SIEMENS PLM SOFTWARE'S NX NASTRAN PROVIDES THE FOUNDATION FOR OPTIMUM PERFORMANCE



For many years, CAD vendors have been espousing the benefits of bringing simulation further forward in the product development process. The argument goes that by providing the designer or engineer with simulation tools products can be tested, validated and optimised more quickly, with less recourse to physical prototyping and costly rework later on. However, the fact remains that many simulation tasks still require a more experienced specialist at the helm. As a result, many organisations that use simulation within the design process have two sets of tools.

For the designer or engineer this means a set of tools that are built directly into the geometry modelling system and allow rapid validation and results inspection. For the specialist this is typically a higher-end suite of applications that are used to perform highly complex simulation tasks. This bifurcation of simulation tools and processes causes several disconnects. First and foremost, both sets of tool will typically use different underlying solver technologies. This introduces several problems into the workflow.

Firstly, the designer can't typically pass simulation data onto the specialist for further work. Yes, results sets can be viewed and inspected, but if the specialist needs to rework or enhance the initial simulation, it needs to be redone. This introduces delays, as models need to be rebuilt, often by de-featuring or abstracting the core 3D CAD geometry, or in some cases rebuilding the model from scratch.

Secondly, it creates a barrier for organisations looking to use their specialists as mentors to the design or engineering department. The knowledge of best practices and process/ workflow used by the specialist can't easily be formalised and reused by the designer or engineer. Data formats are mismatched as well as the age-old problem of a disconnect between language/ terminology.

NX NASTRAN AS AN ENABLER

To solve many of these problems, Siemens PLM Software offers three levels of products in its CAE suite, all powered by common technology and applications including NX Nastran. The base level NX offering features wizards to solve part-based structural and modal simulations integrated into core NX. The mid-range NX Design Simulation is a natural extension to part design, offering structural, modal and thermal simulation, again integrated directly into NX. The high-end offering is CAD-independent and offers system simulation in addition to structural, modal, buckling, dynamics, and heat transfer. It also goes into the realms of non-linear analysis. All three offerings share the same underlying platforms: NX Nastran provides the solver technology, Parasolid provides the geometry handling kernel whilst Synchronous Technology turns on the geometry afterburners.

For those wanting to take a holistic approach to simulation this not only means a common platform for geometry sharing, but also that the simulation set-ups and results are equally as transferable, with data able to be passed up and down the process.

For the designer / engineer, preliminary simulation work can be carried out during the design process then passed onto the specialist / analyst for further work. Using the Product Template Studio it also means that the specialist can create 'sub applications' that encapsulate established best practices and workflows. These can then be reused by the designer / engineer to carry out common simulation tasks and first pass validations without requiring the involvement of the specialist, who can concentrate on the trickier, more involved work.

In terms of geometry transfer, this also gives rise to some additional benefits. By using a common geometry platform, product form can be manipulated, reworked and shared between anyone involved in the process. This not only leads to a greater use of simulation, but more importantly through the use of best practice and tools that are task- and knowledge-appropriate, the products that come out of the end of the development process are of greater quality and more suitable to their performance requirements.

"BY USING A COMMON GEOMETRY PLATFORM, PRODUCT FORM CAN BE MANIPULATED, REWORKED AND SHARED BETWEEN ANYONE INVOLVED IN THE PROCESS"

A CLOSER LOOK AT NX FLOW AND NX THERMAL

WHILE MANY ARE AWARE THAT SIEMENS PLM SOFTWARE PROVIDES ITS OWN VERSION OF THE NASTRAN SOLVER, THEY MAY NOT KNOW THAT THE COMPANY ALSO PARTNERS WITH MAYA TECHNOLOGIES TO COMPLEMENT THE STRUCTURAL ANALYSIS WITH HEAT AND FLUID FLOW CAPABILITIES

Coupling multiple-disciplines in a single simulation is the next stage in the evolution of simulation technologies. While discreet technologies that allow structural and heat/fluid flow simulations have been available for some time, a multi-disciplinary approach sees these combine into something much more powerful.

SIMULATION PARTNERSHIP

Addressing the shift to a multi-disciplinary approach, Siemens PLM has partnered with Maya Heat Transfer Technologies (mayahtt.com) to create a set of deeply integrated Fluid Flow and Heat Transfer add-ons (commonly collected under the umbrella term Computational Fluid Dynamics) for its NX product development system. These are offered as basic and advanced applications which, like the rest of NX's CAE solutions, can be used to create specific new-to-CFD designer wizard-based add-ons, where detailed control is offset against a guided usage scenario that encapsulates best practices.

FLOW AND THERMAL

In the base level, NX Flow and NX Thermal provide a rich set of controls and usage scenarios where users, with experience of the system and a solid understanding of the operating and performance requirements for their products, can conduct detailed simulations. Further on from that are the advanced flavours of these add-ons adding capabilities formerly only available to 'rocket scientists'.

What's interesting is that the various modules and the underlying datasets are all based on the same core technology and the data is transferable between each, both up and down the cost and complexity structure, meaning that an organisation can license the most appropriate tool for the experience, knowledge and functional requirements of its design and simulation team.

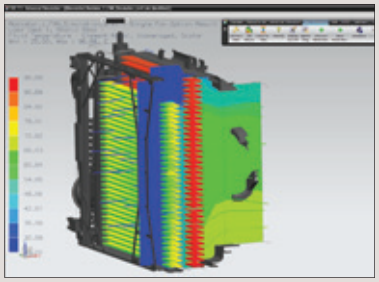
The various modules allow users to conduct all manner of Flow and Thermal simulations in isolation, but also provide the ability to couple together the two disciplines to achieve a much more holistic understanding of a product's performance.

When this capability is combined with the powerful geometry tools within NX, such as Synchronous Technology which allows rapid creation, repurposing and abstraction of 'design' geometry, the result is an environment in which simulation can be used to truly optimise design rather than simply validate it.

Alongside these tools, there are also several special purpose add-ons that take very industry-specific terminology, workflows and best practice and deliver a set of tools designed to solve very specific problems. While the Electronic Systems Cooling module is going to be applicable to a large number of users, there's some enjoyment in the knowledge that there's also a module to assist with the simulation of Space Systems (satellites as well as other 'out of atmosphere' vehicles).

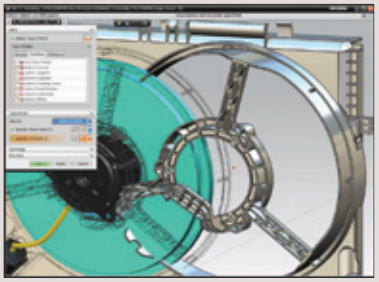
WORKFLOW: SOLVING COMPLEXITY WITH MULTIPHYSICS

1 AN ISSUE WITH HEAT EXTRACTION



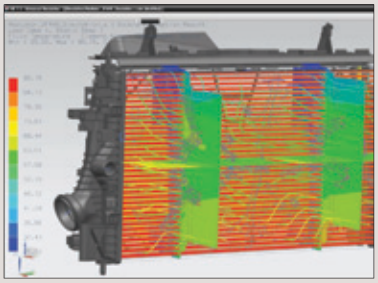
Using a combination of NX Flow and NX Thermal it is discovered that a radiator assembly isn't pulling enough heat out of the system. It is only achieving 36kW whereas 41kW is required for this engine.

2 MODELLING DESIGN CHANGE



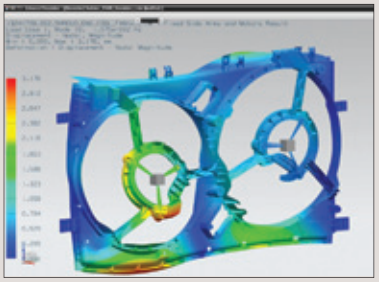
The single fan design concept is quickly modified using Synchronous Technology to take the existing design (including fan and mounting sub-assemblies) and create a two fan variant.

3 VALIDATION WITH FLOW SIMULATION



Further simulation is conducted to ensure that the new design variant achieves the performance requirement of over 41kW.

4 STRUCTURAL SIMULATION



Structural and modal simulation is conducted to ensure that the mounting scheme will support the new design variant with the required performance parameters.

THE VALUE OF MANAGING SIMULATION DATA

AS THE USE OF SIMULATION INCREASES, THE AMOUNT OF CAE DATA WILL GROW COMMENSURATELY. ALONGSIDE DESIGN, MANUFACTURING AND PRODUCTION INFORMATION, HOW DO YOU GAIN CONTROL OVER THIS WEALTH OF INTELLECTUAL PROPERTY?

For many design and manufacturing organisations, simulation holds the key to being able to produce higher quality, better differentiated products, and delivering them in a shorter timeframe. The ability to thoroughly test, validate and optimise a product long before getting anywhere near tooling up for production, has become an integral part of the product development process.

With this movement towards simulation-driven product development comes the inevitable problem of data management. As we test and optimise more, all the data associated with a product's development grows with each iteration, with each solution set created, with each associated design change.

Alongside this, the nature of the information is changing. In addition to the geometric and manufacturing information we also need to capture simulation data in a digital form. This critical information needs to be managed and made available for traceability, reuse and learning. It also needs to be protected as it contains much of the real intellectual property and knowledge within our organisations.

TAKING CONTROL

So how can we regain control over the rapidly expanding assets we create? Over the past few years Siemens has been enhancing integration between its simulation tools and its industry leading Product Lifecycle Management (PLM) solution, Teamcenter.

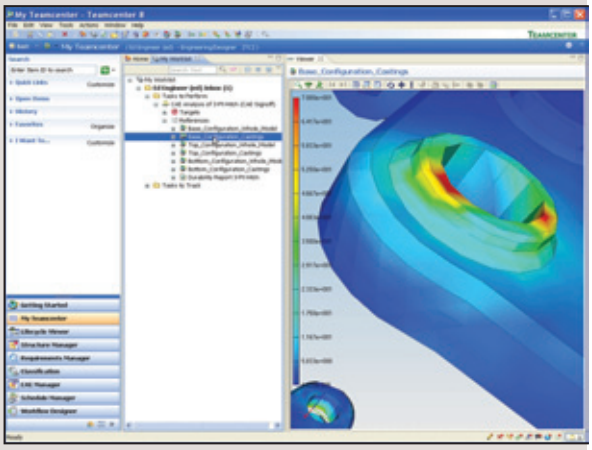
Using Teamcenter, it's not only possible to manage who has access to simulation data, but it can be used to control how, when and by whom the simulation tools can be accessed. It can be used to store CAE-specific variations of geometry that have been through an abstraction process, and simulation users can document potential design change and feed that information back into the process.

With tools such as Synchronous Technology, it's possible for simulation-focussed users to create new part variants, experiment with design change to solve any issues raised, to overcome problems found during the simulation process, rather than having to go back to the design team to request redesign. Problems can be found, dealt with, them information fed back into the system to be rationalised by those responsible. Results and documentation are made accessible to those that need them, without the need for costly post-processing systems – it's all handled in a tracked and managed environment within Teamcenter.

DATA REUSE

The real power of lifecycle management, particularly in terms of CAE, is when the next project comes around. Anyone that's involved in product development knows that issues often repeat themselves and time is often wasted duplicating the same simulation jobs with slightly different inputs and requirements. However, because Teamcenter provides this wealth of information in a controlled and managed system, it's dramatically easier to find how similar issues were solved in previous projects. Data can be reused where needed, as can workflows and processes, or more granular information can be extracted from previous projects. It is all there, searchable and available as and when required.

A recent report by research firm, AberdeenGroup, said that best in class companies are almost twice as likely as the industry average to manage simulation and product data relationships. The question is, are you ready to be best in class?



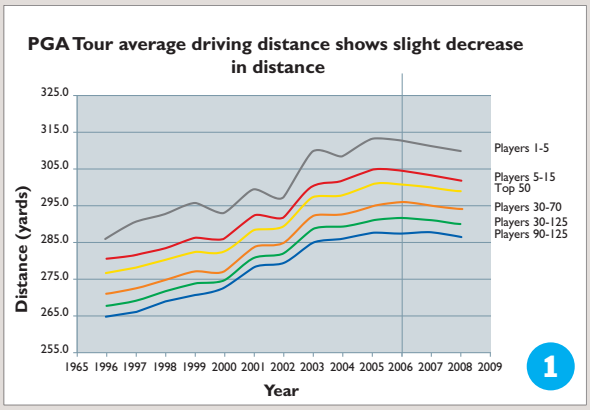
"BECAUSE TEAMCENTER PROVIDES A WEALTH OF INFORMATION IN A CONTROLLED AND MANAGED SYSTEM, IT'S DRAMATICALLY EASIER TO FIND HOW SIMILAR ISSUES WERE SOLVED IN PREVIOUS PROJECTS"

HEAD FIRST: THE NEED FOR SPEED

ADAMS GOLF ADOPTED ADVANCED SIMULATION TECHNOLOGY FROM SIEMENS PLM SOFTWARE TO HELP DESIGN A NEW GENERATION GOLF CLUB THAT OFFERS ULTIMATE DRIVE DISTANCE DUE TO ITS SOPHISTICATED AERODYNAMICS

For a relatively small company Adams Golf, a Texas-based golf club and equipment manufacturer, certainly caused a stir in the golfing world last year when it launched its Speedline FAST 10 driver - a club that retains a large driver head but has low aerodynamic drag force. It was also the company's first product to integrate both Siemens PLM Software's NX Flow application for CFD analysis as well as aerodynamic wind tunnel testing into the product development process. "We are a small fish in a very big pond so we are constantly competing with other larger companies to gain market share. NX Flow has definitely given us a competitive edge," says Jeff Albertsen, a design engineer at Adams Golf.

The creation of the Speedline FAST 10 started when Adams Golf began noticing a peculiar trend amongst golfers. "We've seen driving distances actually decrease over the last couple of years," claims Albertsen. "I think the trigger was driving distance on the PGA Tour. These are obviously the best players in the world so if there is a trend there, it's most likely to be a trend in the rest of the industry. We decided to test why is this happening. Why are the distances decreasing?"



1 PGA Tour statistics showing how drive distances have declined since 2006. This, according to Adams Golf, is due to a reduction in club speed due to aerodynamic forces as head size has increased

Through extensive player and aerodynamic wind tunnel testing Adams Golf discovered that large MOI (Moment of Inertia) club heads, those with displaced volumes at or near 460cc, are subject to aerodynamic forces large enough to impact club head speed. So, they identified the problem that as manufacturers strove to meet all the requirements of the ruling authorities of golf, namely the Royal and Ancient Golf Club of St Andrews (R&A) and the United States Golf Association (USGA), they converged on driver head shapes that have been a detriment to driving distance among all golfers due to poor aerodynamics.

As a result of these revelations Adams Golf set itself a design challenge of creating a 'large footprint' 460cc driver head with low drag to increase club head speed and ultimately distance. "This discovery led us to go down the path of designing large heads that were low aerodynamic drag," confirms Albertsen. "We wanted to offer a driver that would hit the ball the furthest of any other driver in the golf store."

In order to improve on the design of the original Speedline in a new driver model - Speedline FAST 10 - Adams Golf decided to use NX Flow simulation software. For the past seven years the company had already been using NX CAD and rendering software in its product development process and then just over two years ago

2 Big in size, low on drag: Adams Golf's Speedline FAST 10 driver

decided to implement NX Flow into this process in order to perform CFD analyses on each iteration of the design as it is being developed.

"Speedline FAST 10 driver was really the first driver we were able to go in and make design changes based on the use of the NX Flow software," says Albertsen. "We were able to make subtle modifications to the face area and the transition areas from the face to the body of the club to help keep that airflow attached and reduce drag even more. Using the NX Flow software, we were able to run simulations on several different iterations of the design and ultimately find the final design that was the lowest drag."

PROOF OF THE PUDDING

Once the Adams Golf design team was happy with the 3D model a prototype was produced which then underwent real player as well as wind tunnel testing to further validate the final design. "Every time we get a prototype in we run wind tunnel testing and we also do player testing. This is just to validate the simulation results," comments Albertsen. "To this date since we have started using NX Flow we haven't had to make any changes, the physical data has matched up pretty well with the simulation."

The key advantage for Adams Golf of using NX is that all those involved in the product development process work in an integrated environment. So, Adams Golf's engineers are able to leverage the same models that the industrial designers use for CAD and rendering in order to undertake analyses and run simulations. "We can take our 3D model, just click a button on the NX screen and we're in stress and strain analysis. Click another button and we're in a deflection analysis. Click another button and we're running flow simulations. So being able to integrate all those different analysis tools right into our 3D modelling software has benefited us greatly," explains Albersten.

Jan Larsson, EMEA marketing director at Siemens PLM Software, comments, "With Adams Golf it is a typical use of NX. The value that they get out of NX and where they really benefit from this integrated solution is being able to do a very quick analysis, get the results and then go back to the design phase, in this case change the club heads, to optimise the design based on the analysis results. So, when they look at airflow around the club heads they can make a decision very quickly whether this will be a product that works properly or not and if not they can go back and do alternative designs and look at the results very quickly and iterate the design around the analysis results."

SPEED TO MARKET

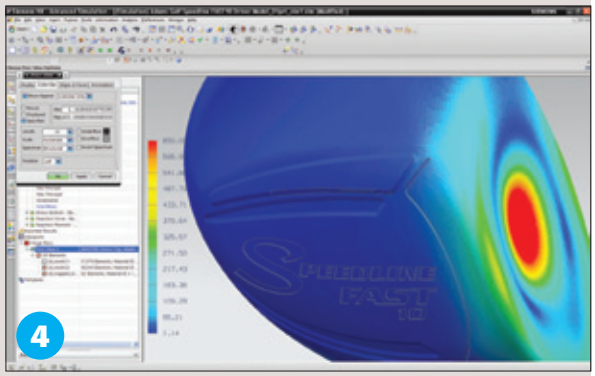
By using 3D design together with analysis tools, Adams Golf has also been able to shorten its product development cycle significantly and, in the highly-competitive golf equipment market, this means launching new products more frequently. "The typical manufacturing process for us - from conception to seeing actual prototype parts - is anywhere from 30 to 60 days," says Albertsen. "Now using the NX Flow software, we can design, test the design, validate that it's going to work and actually have a real-time working concept in probably less than 20 days. So by using the NX software, we can cut down on manufacturing lead times, we can cut down on manufacturing costs, we can cut down on testing times."

The Speedline FAST 10, with its large dimension and low aerodynamic drag force that enables increased club head speeds and greater distance for golfers, was launched in 2009 to high acclaim. Since launch the driver has not only been involved in several tour victories but has also received a number of awards including a gold award in the Golf Digest 2010 Hot List. Adams Golf was also the first golf club manufacturer to be honoured with a Progressive Manufacturing (PM100) award for its application of CFD analysis in the design process.

NX product development software is now integral to its innovation and success and as Tim Reed, Adams Golf's vice president of research and development, concludes, "The role NX ultimately plays is speed to market, providing us extraordinary flexibility and adaptability to the ever-changing environment of the golf industry."

www.adamsgolf.com

"SINCE WE HAVE STARTED USING NX FLOW WE HAVEN'T HAD TO MAKE ANY CHANGES, THE PHYSICAL DATA [FROM WIND TUNNEL TESTING] HAS MATCHED UP PRETTY WELL WITH THE SIMULATION"



3 NX Flow was used to locate critical areas in multiple head designs meaning fewer prototypes needed to be made

4 Stress plot using NX Advanced Simulation

NX FOR MANUFACTURING ENGINEERING

WHEN IT COMES TO MANUFACTURING ENGINEERING AND PRODUCTION, THERE ARE ALL MANNER OF SPECIALISMS, NICHES AND REQUIREMENTS THAT NEED TO BE ADDRESSED. WITH THE NX PLATFORM THE WHOLE REALLY IS MORE THAN THE SUM OF ITS PARTS

As a product development system, NX is a giant. From basic part design and assembly creation to simulation and into the realms of production preparation with tooling design and machine tool-path creation, it has a wide range of tools to suit almost everyone involved in product development.

At its very core, the NX design system allows the user to create digital models of products under development. However, in addition to the model being geometrically accurate, it can also include sophisticated information about how it behaves structurally (using analysis tools), how it behaves in use (using kinematic simulation), how it should be produced (using a wealth of tooling and CAM tools), what tolerances it should be made (stored using Product Manufacturing Information - PMI) and how it should be installed, serviced and maintained.

Bringing all of this together in a single modular platform has many advantages and adds real value to the downstream manufacturing process. So let's take a look at the advantages this brings and the cornerstones of the NX Manufacturing suite.

A COMMON ENVIRONMENT

By defining a product on the same platform that will be used during manufacturing preparation, there are several advantages. The first is associativity. Working with intelligent native data, design changes can be propagated through to manufacture much more quickly than could be done when using disparate systems. Part design

CASE STUDY: UNIVERSAL STAMPI

Universal Stampi specialises in the design and production of die-cast moulds for aluminium, magnesium and zamak. The Italian firm also produces gravity die-casting and plastic injection moulds. Its key strength lies in the fact that it keeps the entire mould-and-die production process in-house. This translates into significant cycle time reduction and high product quality.

In the typical development process at Universal Stampi, the customer foundry submits an item to be moulded, which can be more or less industrialised and production-ready.

Mould construction starts in the design phase, as Stefano Masieri, designer and business partner, explains. "We work concurrently in design and manufacturing. This approach implies some risks, of course, but it is a distinct way to generate added value for our customers."

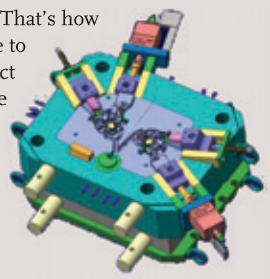
Universal Stampi manufactures 125 moulds annually – highly complex tooling mostly addressed to the automotive industry in Europe, China and India. Mould models are submitted for different types of analysis and simulation using specific software, and then transferred to the factory, where 26 machining centres with advanced CAM software await.

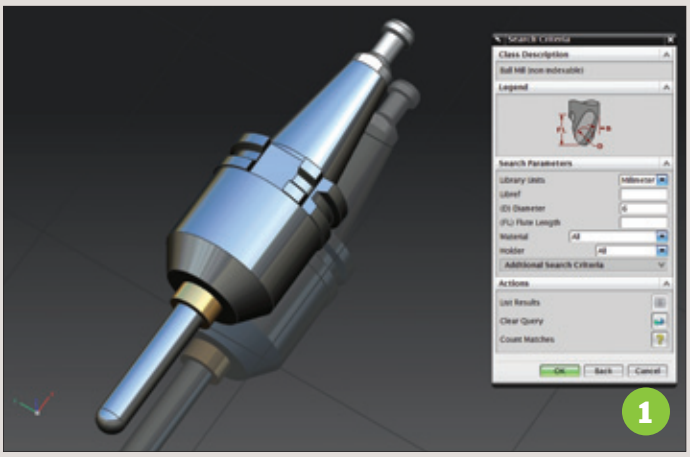
Design software plays a key role and the company recently introduced NX. The first advantage that was noted was parameterisation, which is useful for making adjustments on the fly. "A customer may ask to change the size of a die or boss," explains Masieri, "and in such cases, parameterisation offers huge benefits."

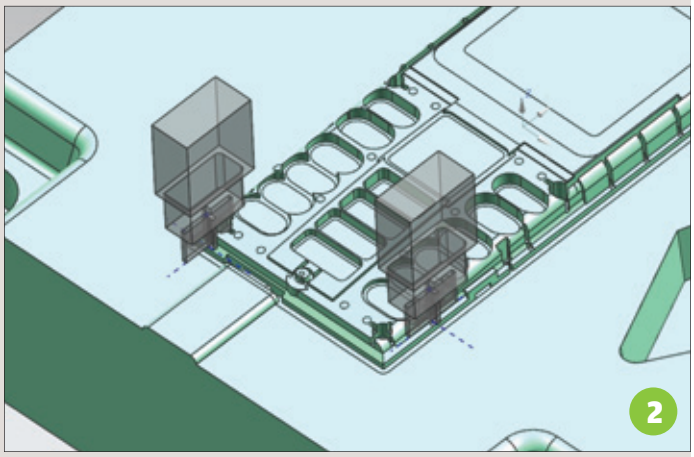
Universal Stampi licensed both NX and the NX Mold Wizard application. "With NX, we can manage the entire project in 3D with fully associative drawings, leveraging the real capability to develop a part concurrently with the corresponding mould," explains Masieri. Each modification to the part is propagated to the mould. This is very important for Universal Stampi's varied development needs, be they starting from scratch to make a new mould or re-engineering an existing product, which is more often the case.

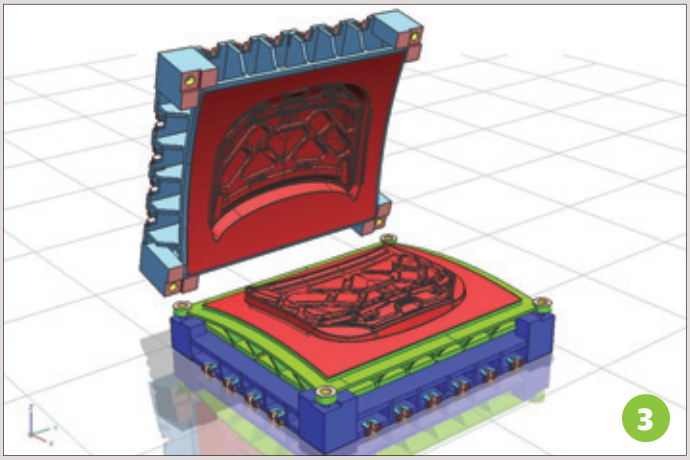
"The greatest benefit of NX is its huge flexibility," confirms Diego Tavelli, chief designer. "With NX you can do virtually anything and you never end up in a blind alley. You always find a way around any issue, a solution to any problem, because the designer is not constrained to a rigid approach. That's how we have been able to reduce our product development cycle time by 20 to 25 percent."

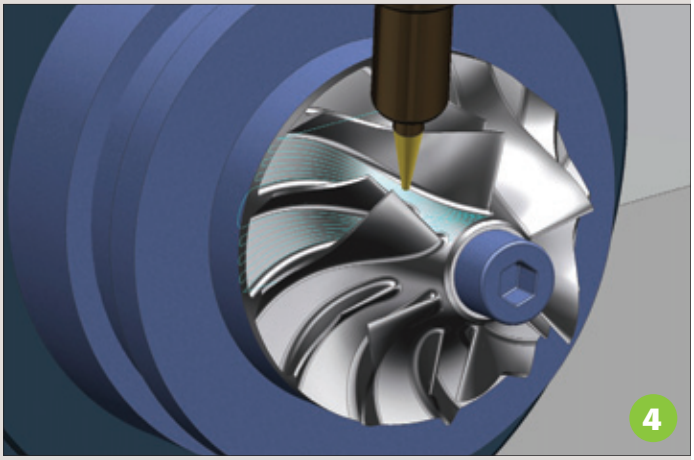
universalstampi.it











changes can be pushed to NC tool-paths, and changes can also be incorporated into tooling and fixture design much more seamlessly.

TOOLING OF ALL STRIPES

There are a wide range of 'tooling' options for the NX platform, but perhaps the most commonly used are the injection moulding tool design modules, with core and cavity development and standards-based mould base design that allows users to create a fully detailed and documented mould stack. There's an electrode design tool which enables geometry to be extracted and patched in; electrode designs to be created; reuse positions to be identified; tool-paths for cutting the electrodes to be created and all of their use documented. There are also more specialised tools to assist with progressive die development (in itself a highly complex process) and stamping die design tools that are focussed on the large scale dies used in the automotive industry.

MACHINING PAR EXCELLENCE

When it comes to machining, CAM and NC programming, NX has a formidable reputation and the range of tools on offer is extensive. From basic 3-axis and 5-axis milling to high-speed machining and into the realms of mill/turn and wire EDM, there is something for everyone. The benefit of having tight integration with the NX platform is that users have a wealth of tools to assist with preparing data for production. Further development work will help make even more use of intelligent NX product models.

Tools introduced into NX 6 allow the generation of machining operations based on pre-defined geometry features and can be automated using the associated PMI 3D annotation sets. Extending the use of PMI, NX 7.5 sees the introduction a dedicated module for CMM programming that extracts the information to create inspection processes.

CLOSING THE LOOP WITH INSPECTION

This latest NX 7.5 release sees the introduction of the NX for CMM module that brings automation tools to inspection programming while retaining the ability to fine-tune the process to individual requirements. This closes the loop on the process, as it allows users to gauge the quality of manufactured components against the requirements of the design data.

Alongside this, modules such as Shop Documentation allow users to create the documentation required on the factory floor. This includes setup sheets, operations sequence information and tool lists, all of which need to be supplied along with production information. With this module, NX CAM can automatically generate shop documentation and output it in a range of formats, including ASCII text or HTML Web format, ready for printing or direct browser viewing on the shop floor.

AVAILABILITY FOR THE SMALLER SHOP

While all this talk of highly integrated part-to-production processes is fascinating, for many small organisations it is likely to remain the stuff of dreams. Fear not, firstly the Siemens NX offering can be implemented with just one application - thousands of small shops have just one license of NX CAM for example. The NX CAM software is available in modular packages so you can go for just a fixed axis milling package, add machining simulation and so on. You can start with any of the key applications such as mould design, CMM programming or CAM and expand as needed later.

Also, to address those customers using or buying the Solid Edge CAD product, or who really want a modular, standalone CAM solution with no specific CAD flavour, Siemens has taken its CAM software and released it as CAM Express within its Velocity Series Portfolio. CAM Express has enough built in CAD capability for basic model editing but, unlike NX CAM, it is not offered with options for more complete sets of NX CAD functions.

The Express role developed for CAM Express boosts the ease of use, adds tutorials and makes for a faster start for new customers. It is also wrapped into every package of NX CAM so everyone benefits from this valuable, faster start up addition.

1 A good example of the benefits of integrated CAD/CAM is the ability to accurately model tool-holders and cutters then add manufacturing information

2 NX for Electrode Design module offers a step-by-step creation process which makes use of data and physical electrodes

3 Stamping Die Design for the automotive industry

4 NX for Turbomachinery adds in special terminology, intelligence and knowledge-based workflows to NX's existing NC programming tools

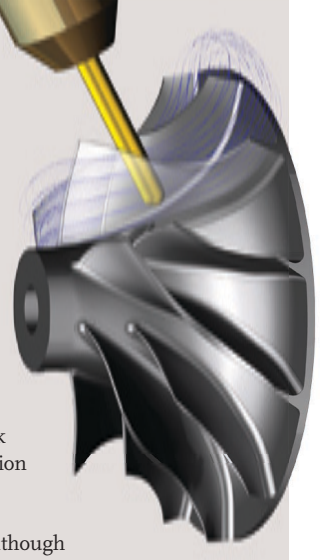
SIEMENS PLM SOFTWARE NX FOR TURBOMACHINERY

FOR THE EFFICIENT MACHINING OF TURBOMACHINERY COMPONENTS SPECIALISED TOOLS CAN GIVE USERS AN EDGE. NOW, WITH NX 7, SIEMENS PLM SOFTWARE HAS INTRODUCED A DEDICATED TOOL FOR THIS COMPLEX PROCESS. WE GIVE AN OVERVIEW OF THE SOFTWARE.

NX has a solid reputation for its high-quality NC programming tools which are used in all areas of industry. And while many of its tools are general-purpose, solving machining problems for all users, there are some industries that can benefit from something a little more specialised. NX 7 introduces a range of dedicated tools for machining turbomachinery components (blisks, impellers etc) so let's explore things in more detail.

Industry terminology: The NX for Turbomachinery module presents all of the various operations and options using language familiar to those working in the industry. Terms like blade, splitter, and hub allow the user to define geometry as specific components, then the operations pick up those definitions and reuse them where appropriate.

Controlled roughing: When roughing, a limit can be set for the volume that is removed in any tool path operation. For example, the top 50% of the blade can be machined in one operation. Impeller blades tend to be long so the extents of the blade can act as a long cantilever and significant deflection can be experienced as it is machined. Stiffening the blades with the bulk of the blank will minimise deflection during machining.



Flexibility in pattern selection: Although automation is important for shorter, easier NC programming, flexibility is important and there are many options to tailor the process. For example, while NX will automatically find the leading and trailing blade edges the user can adjust these positions to refine the path. It is possible to specify: which corner will start the machining pattern; the type of pattern, whether that's climb or zigzag; whether the stepover is from the left blade to the right blade or vice versa; or if it is to be in 20 passes, or defined by giving a scallop height of 0.2 mm or 6 mm depth of cut or 20% of the tool etc.

Rest milling: This procedure is particularly strong as NX manages an active 'in-process' model of the work-piece and is aware of what has been machined and where material remains. For example, when material is left by a larger cutter between the base of a splitter blade and a main blade, NX CAM is able to target this uncut material automatically saving programming time and giving a much more efficient machining process. The in-process work-piece also works between turning and milling which is valuable in turbomachinery where both processes are commonplace.

Tool axis control: This is critical when trying to balance the rigidity of the cutter (using as short length as possible) against the depth required to reach the material, while ensuring good surface finish and removing any potential collision. Within NX it's possible to define the tool axis as required and then specify how much the tool should lead or lag. This is especially important when using ball and end mills, where the bottom tip does not have a cutting edge, so a leading edge can be created by tilting the tool. The user can specify the lead and lag for the leading edge and the trailing edge separately and a tool axis gets interpolated in-between. These parameters can be specified at the shroud and the hub and the software interpolates the increments required to transition from one to the other.

CASE STUDY: STORK TURBO BLADING

Based in Sneek, Netherlands, Stork Turbo Blading is part of the Stork Power Services division of the industrial Stork Group, providing a broad range of turbine dimensions, from 50 to 1200 mm, and producing 80,000 blades a year.

"We do that with eleven engineers, six quality assurance specialists and 40 production staff," explains Gerrit Mulder, engineering manager. "But in spite of our significant manpower, we never would have been able to reach this production and the level of quality if we had not figured out better working methods for engineering, work preparation, production and the associated tooling." By tooling, Mulder is not just referring to the 4-axis and 5-axis milling machines, "The real advantage lies in the efficiency of the process before the data goes to the machines," Mulder says. "And this process can only be achieved with the right software."

Stork Turbo Blading uses NX to engineer the blades and generate NC paths. "It fits within our organisation. The functionality is what we want. And the applicability to our products is very good."

It is important for Stork that multiple engineers are able work on a design simultaneously. Based on the STEP model (created from a reverse engineered model), the base and blade are developed separately. According to Mulder, "We also find it important to be able to develop the fixtures in parallel. This is possible thanks to the NX working method based on a 'master model.' In addition, the perfect integration between CAD and CAM ensures that modification cycles become extremely short."

"Before NX, we would spend on average three days generating NC paths after an adaptation of the design. Thanks to the integration of NX, this is now done in half an hour," he adds. "However, time saving is not the only benefit. The risk of errors is lower because the generation of NC paths is almost an automatic process."

www.storkpowerservices.com

SIEMENS PLM SOFTWARE NX FOR CMM

NX 7 INTRODUCES A NEW SUITE OF TOOLS THAT HARNESS THE POWER OF MODERN METROLOGY EQUIPMENT AND IN COMBINATION WITH 3D ANNOTATION AND AUTOMATION TECHNIQUES HELP MAKE THE INSPECTION PROCESS MORE EFFICIENT AND MORE REPEATABLE

Inspection, metrology or quality assurance - call it what you will - is the process of measuring production components and checking them against their originally defined dimensions and tolerances. The techniques and technologies used for this process have changed dramatically over the last few decades and manual measurement tools have largely been replaced with more advanced and efficient tools. One such tool is the Co-ordinate Measuring Machine (CMM), a technology that has advanced greatly in the last few years. There is now much more automation which allows a larger numbers of points and references to be taken in a shorter timeframe and leads to a much greater understanding of the variation of parts. The downside of this is that the programming required for the inspection processes becomes more complex and when a machine is capable of measuring 100s of points in minutes, traditional manual methods won't suffice.

The good news is that with the increased use of 3D annotation data (PMI – Product Manufacturing Information) within a 3D product model it is now possible to reuse this data to drive inspection programming and dramatically reduce implementation time. Acknowledging this trend, Siemens PLM Software has introduced a new module for the NX 7 release that enables all this and more. It's called NX CMM Inspection Programming. So let's take a look at how it can enhance a typical quality assurance workflow.

The new NX CMM Inspection Programming module is fully integrated into the NX environment, building on the existing geometry and PMI editing and creation tools. This also allows the team to take advantage of the existing tools for NC machine programming and simulation on which much of the new module is based. The process begins by selecting the measuring machine from a library. This contains a geometric model of the machine as well as knowledge of its operating limits, in terms of movements. Into this model, the part that is to be inspected is brought in and positioned and the 'Link PMI' command activated.

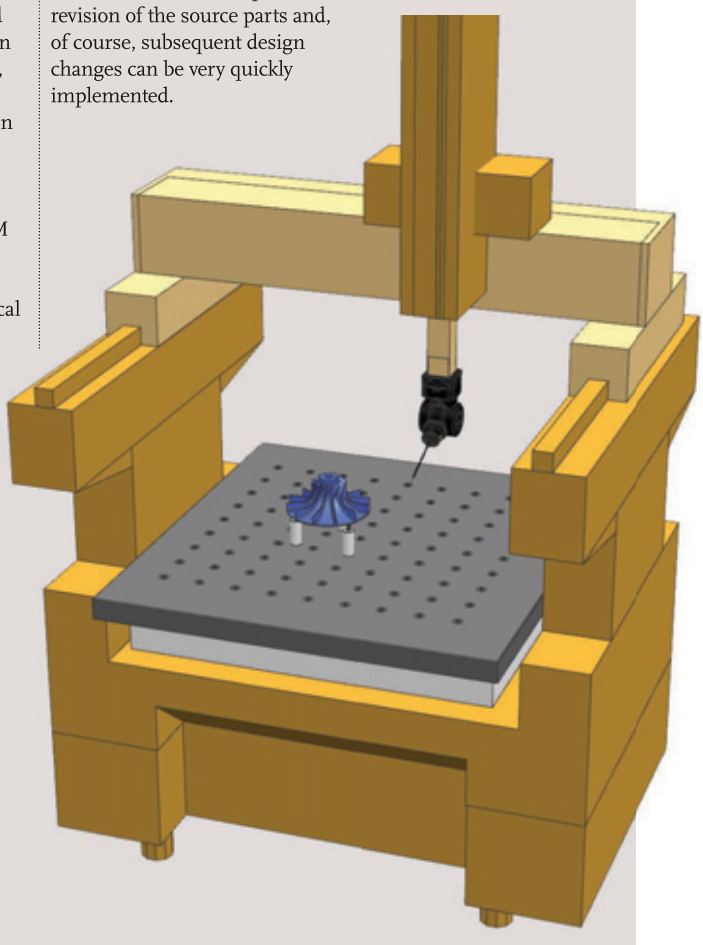
> "WITH THE INCREASED USE OF 3D ANNOTATION DATA WITHIN A 3D PRODUCT MODEL IT IS NOW POSSIBLE TO REUSE THIS DATA TO DRIVE INSPECTION PROGRAMMING"

Any PMI information required for the inspection routine that is contained within the model is then extracted, including tolerances, dimensions, features, and datums. This data is then used to generate the movement of both the CMM and the inspection device based on the feature being inspected (the system currently handles 3-axis scanning and up to 5-axis touch-trigger probing). It is thought that this can remove 80%+ of the programming time.

Of course, not every organisation uses PMI, so the good news is that the system also allows users to dive in and create each measurement manually, but using built in knowledge about the process and requirements to make it much more efficient. A menu shows the inspection features and operations creation tools and the user simply grabs the pre-defined inspection method, selects the points or features on the model geometry and NX generates the appropriate path.

In addition to the programming features of the software, NX for CMM also includes a raft of tools for both simulation and verification. When dealing with multiple movements of the machine, the probe and, in particularly complex processes, the part itself, there's a huge potential for collision. Benefiting from the software's background in NC programming, these tools are available to check the program before it gets anywhere near the inspection office. Once complete and verified, the system outputs the code to drive the measuring machine, using a range of post-processors in a number of different languages, such as DMIS (Dimensional Measurement Interface Specification) or the more proprietary GeoMeasure or Calypso.

Finally, for those using Teamcenter, all of this information and knowledge can be managed: templates, tools, probes, inspection rules, as well as inspection programs and output files. These can be linked to the most up-to-date revision of the source parts and, of course, subsequent design changes can be very quickly implemented.



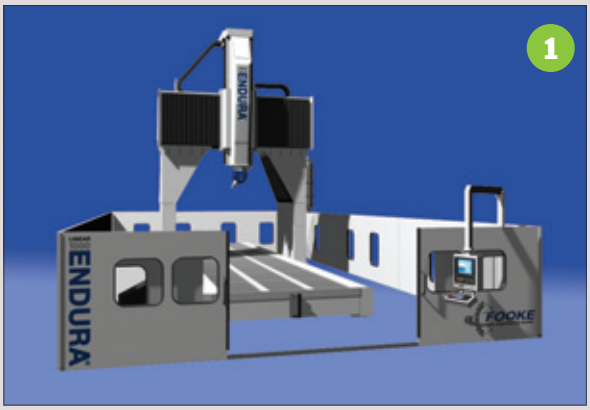
A NICHE FOR MILLING

THE BIG ONE

AN END-TO-END PRODUCT DEVELOPMENT SOLUTION FROM SIEMENS PLM SOFTWARE IS HELPING STREAMLINE THE DEVELOPMENT OF VERY LARGE MILLING MACHINES THAT ARE CAPABLE OF MILLING STRUCTURES UP TO 100 FEET IN LENGTH

As a family business with more than 100 years of tradition, Fooke GmbH has created a niche in the machinery industry that suppliers in Europe, India, China and the USA can't match: very large milling machines that are sold as complete, customised systems. In addition to the machine itself, the system includes the clamping solution and tools as well as measuring and NC programs. These machines can: mill aluminium railway structures up to 100 feet long; perform high-precision processing of vertical tail units; create high-precision skins made of CRP, GRP and aluminum; perform high-speed milling of models for the automobile industry; and address many other specialised applications.

The steadily increasing demand for these machines in the world market, as well as the increasingly complex technical requirements, motivated this innovative enterprise with approximately 170 employees to upgrade its product development process. In particular, management wanted employees of different divisions to work more effectively as integrated project teams. They also wanted to be able to combine heterogeneous IT systems into a complete package for the customer (a five-axis, high-speed milling machine, clamping solution, NC programs and measuring programs as well as comprehensive documentation for worldwide deployment). In addition to requiring durable production machinery, customers have come to expect more comprehensive after-sales services such as retooling, expansion, maintenance and warranty claims.



1 **The ENDURA 1000LINEAR milling machine was developed entirely using the Siemens platform**

INTEGRATED SOLUTION IS A PERFECT FIT

In 2004, the company began searching for a 3D CAD solution for its fifteen design engineers as well as a CAM module that supported high-speed and five-axis machining. "We looked at all the reputable systems on the market," says Hans-Jürgen Pierick, who as team leader of the systems' specialists coordinated the selection process. Five CAD systems with different CAM combinations were evaluated in conversations, demonstrations and trial installations.

Fooke chose an end-to-end, integrated product lifecycle management (PLM) approach from Siemens PLM Software that included the NX digital product development solution, the NX CAM system, the NX Nastran Finite Element Analysis (FEA) program and the Teamcenter digital lifecycle management solution. In addition, the company implemented the VNCK virtual NC system for machine-specific simulation of the Siemens 840 D CNC control. "It was a solution-oriented, unified concept that was a perfect fit for us," says Pierick.

The advantages of this solution became evident even during the pilot program. Having integrated CAD and CAM systems put an end to interface problems, savings hours of conversion labour. And having a common "language" – Teamcenter – improved cooperation among the different divisions.

ADVANCED MACHINES NOW POSSIBLE

Since 2006, all new Fooke machines have been completely developed on the Siemens platform. In particular the new models of gantry milling machines with overhead bridges –

2 Fooke's travelling column milling machine, the ENDURA 1005LINEAR is one of a new breed of gantry milling machines with overhead bridges

the ENDURA 900LINEAR with linear drive, and the travelling column milling machine ENDURA 1000LINEAR – show how the benefits of the new solution extend to the end user. This new generation of machines is characterised by an elevated, movable bridge. The use of FEA during the design process resulted in a bridge with higher rigidity, reliability and precision.

A machine of this type is used for the five-axis milling of the Superjet 100's outer skin, which is made of 1.5-millimetre aluminium (AlMg3) sheets. The bridge moves seven metres in the X axis, 3.5 metres in Y and 1.5 metres in Z. The A axis allows +120 to -95 degrees mobility, while the C axis allows +/-275 degrees. Innovative clamping technology consists of 200 actuators, each of which bears a vacuum suction cup and can be positioned via NC control. The positions of the individual actuators are programmed in the CAM module. The actual positions of the component are determined with Renishaw probes.

The Siemens 840 D was selected as the control system for these varied tasks. It has strengths not only in five-axis milling but also in the special applications of measuring, setting the neutral zero points and positioning the actuators. The CAM platform adds other strengths. "NX supplies a robust, open CAM system, which is expanded in a program written with Visual Studio .NET in order to output measuring and control programs for the Siemens 840 D," says Klaus Harke, CNC system specialist at Fooke. "This is followed by the programming of the five-axis contour processing."

The entire program can now be simulated using the virtual NC kernel VNCK with machine-specific parameters such as mass and inertia. As a result, for the first time it is possible to ensure that a concept solves a given problem without damaging any expensive components.

The benefits of the Siemens platform have been especially evident in this project. "Programming the machine during development made it available to the customer sooner," says Pierick. Computer simulation ruled out many of the risks associated with innovative machining techniques. In addition, showing the simulation to the customer created confidence in Fooke's problem-solving skills. It also facilitated implementation and training. The delivery of an entire CAM process that had been defined on one platform ensured a successful solution for the customer. Teamcenter tied together the entire package by providing immediate access to all the product information necessary for later retooling, maintenance and service.

FURTHER EXPANSION PLANNED

"The integration of the Siemens system is what brings the benefits," says Pierick. Of course, Fooke passes these benefits on to its customers. Every manufacturing facility meets customer needs with the application of key production machinery. The high performance of Fooke machines is a strong selling point, which is not to be underestimated in the capital goods business.

Due to these advantages, the digital product development system is currently being expanded. The company is going to use the viewer functionality of Teamcenter to make product information available to people involved in marketing and production. And with Fooke's software supplier, Siemens PLM Software, being part of the Siemens enterprise, Fooke has a single source and integrated solution for both its internal and external manufacturing environments.

www.fooke.eu

"THE INTEGRATION OF THE SIEMENS SYSTEM IS WHAT BRINGS THE BENEFITS... IT WAS A SOLUTION-ORIENTED, UNIFIED CONCEPT THAT WAS A PERFECT FIT FOR US"

SYNCHRONOUS TECHNOLOGY FOR MANUFACTURING

WHILE NX IS WELL KNOWN FOR ITS ROLE IN PRODUCT DEVELOPMENT WORKFLOWS, THE INTRODUCTION OF SYNCHRONOUS TECHNOLOGY INTO THE HEART OF THE SYSTEM MEANS IT CAN ALSO BE USED TO GREAT EFFECT BY THOSE WORKING IN MANUFACTURING

There is no doubt that NX offers excellent tools for the manufacturing engineer to work with models from any source. The typical NC programmer can easily spend 20% or more of his or her time fighting with 3D models before even thinking of adding a tool-path. Radii may need to be changed, openings closed off, geometry added to drive NC tool-paths or containment volumes, or models even created from drawings.

Alongside this, manufacturing engineers also receive high volumes of third-party data that have to be translated into NX, removing intelligence. This can be hard to work with without a high degree of CAD expertise in traditional systems and a remodel is never far away once the clock starts ticking and the frustration levels rise. Even with native, fully defined 3D models containing all of the design features and parametric data, the manufacturing-focussed engineer may have no idea how it was created, may not have the tools needed to exercise those features to make the required edits, or simply not know how to use these functions.

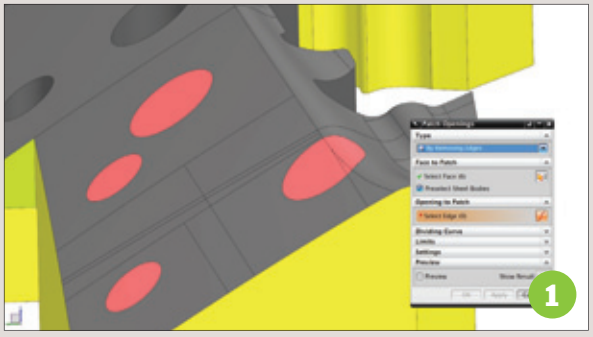
What if the user could just click a face and patch in a hole, click a rib and drag it 10mm along the part and still leave it fully connected, fully blended as was, but in a new position, with no special modelling skills and without the dreaded remodel. This is what Synchronous Technology can offer in NX (both NX CAM and CAM Express) so let's explore a few common usage scenarios.

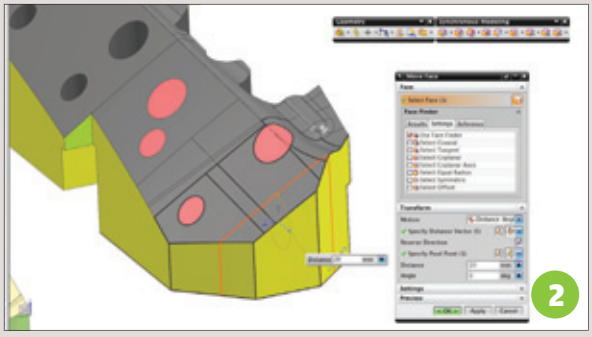
General model changes: There can be many reasons why a tool designer or NC programmer needs to change a model - perhaps to move a rib, to alter a draft angle, to move a hole or lengthen a pocket for manufacturability, or simply because of a good old-fashioned design change. This can happen after the part is programmed or the tool designed. No problems in NX; even if the 3D model was a translated dumb shape, with Synchronous Technology these changes are easy to do even with really limited CAD knowledge and with no idea how the model was built. Then because of the associativity that the NX system has always had – the tool design or the tool-path can be updated to suit the new geometry.

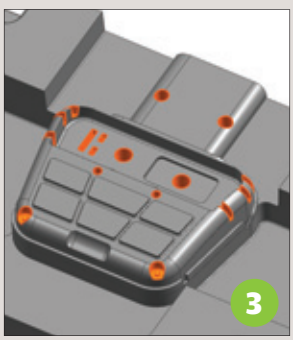
Model clean up: Many times imported models have dozens of modelling errors in them. Mismatching surfaces and gaps are common and these can throw off a CAM tool-path processor completely, often ending in a partial or complete remodel by the frustrated NC programmer, not to speak of hours wasted. NX has several levels of capability to 'repair' these broken models, finding the errors and giving the user options to heal the geometry ready for programming.

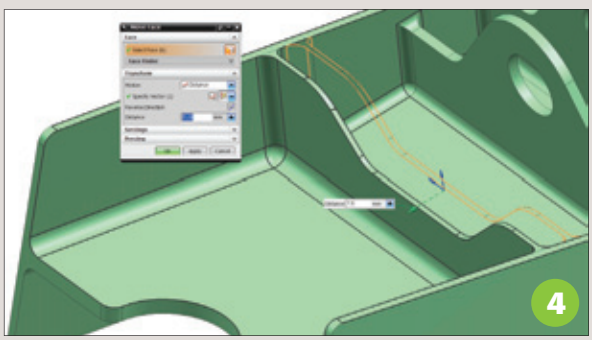
Closing openings: Finished part models don't represent the stage models that are needed to define machining operations. For example, holes in parts may often be the last features to be machined yet they appear in the finished part CAD model. For efficient machining from stock to the finished surface, pre-drilling operations, the NC programmer would like to have a model with the hole features suppressed. With Synchronous Technology the user can close off openings over holes or pockets in "dumb" models with patches that blend into the surrounding surface geometry – in a single click.

Castings & machining stock: The NC programmer or tool designer will often need a model that's larger than the finished part and more material may be required on one surface than another. With Synch Tech options the user can grab any surface and pull it into a new position with complex surfaces extending logically to keep the model intact - even on dumb geometry.









1 Synchronous Technology allows the NC programmer to create patches over openings with surfaces that blend into the surrounding model shape

2 The move face command allows faces to be grabbed and dragged on any 3D model, maintaining any connection relationships and making the addition of machining stock much easier

3 Electrode design requires both the extract of the electrode geometry and the patching of the holes to create a contiguous surface for machining. Here the hole pattens have been selected in one operation and then deleted with the geometry closing up in a single operation

4 With Synchronous Technology it is possible to make some complex edits with a single selection on any 3D model such as this rib and adjacent fillets