

# DEVELOP 3D

TECHNOLOGY FOR THE PRODUCT LIFECYCLE

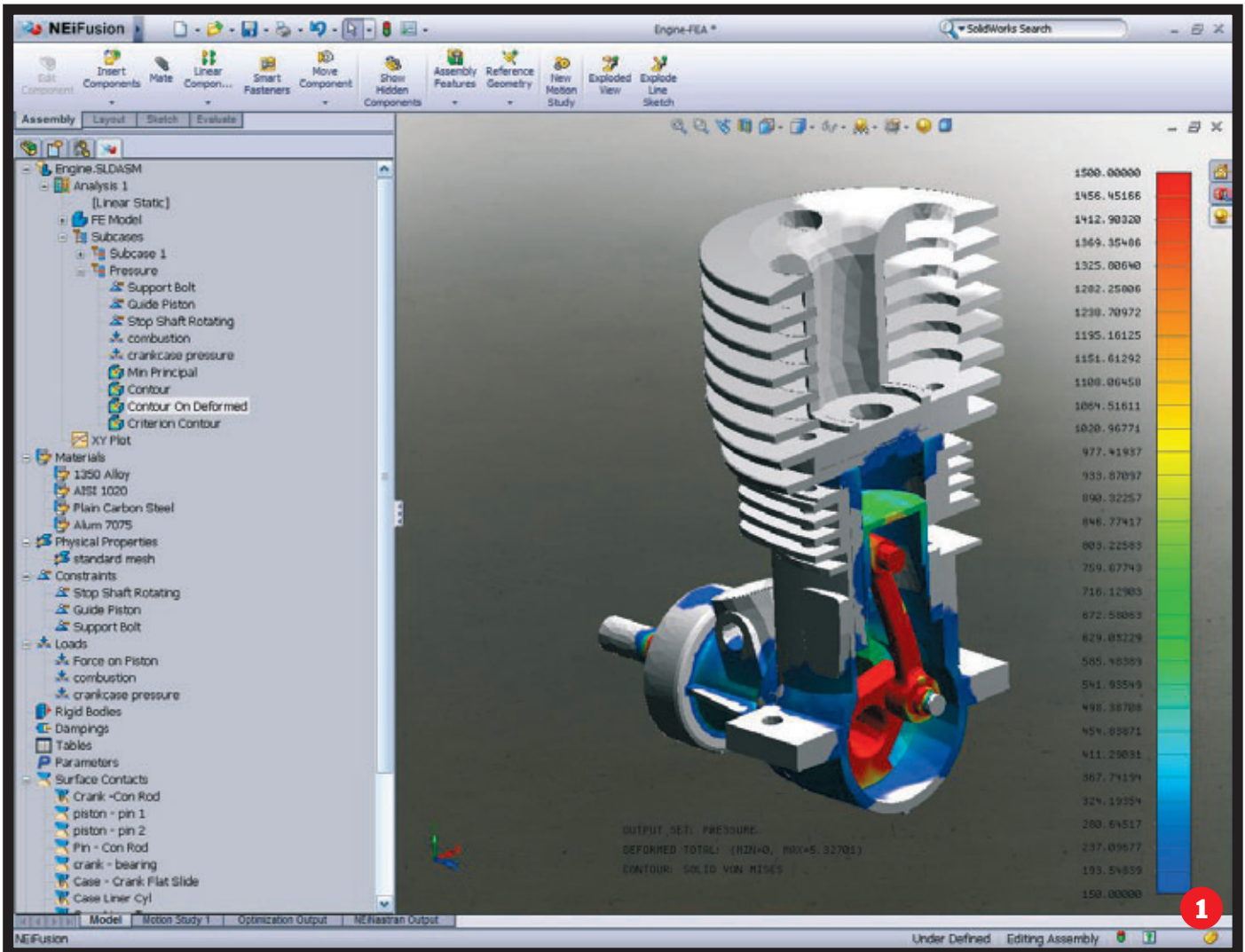
APRIL 2009

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## **TURBO BOOST**

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AND MANUFACTURE AT  
NAPIER TURBOCHARGERS**

**INTEL XEON 5500**  
Workstations go core crazy



## NEi Fusion

» **Al Dean** reports on NEi's standalone simulation package, which uses the foundation of SolidWorks, one of the leading modelling packages, to give engineers and designers access to powerful Nastran-based analysis while maintaining incredible ease of use

**A**s a field within the world of technology for product development, analysis and simulation is gaining major traction - and rightly so. Engineers and designers face economic, time and environmental pressure to develop higher quality products, at lower cost. By adopting both FEA (Finite Element Analysis) and CFD (Computational Fluid Dynamics), they have the ability to simulate a product's structural (using FEA) and fluid flow or heat-based performance (using CFD) and improve upon them with each design iteration. Amongst the often bewildering array of technology available, the nuts and bolts that make it work are arguably the most important thing. This technology, the solver, is key to making the whole process work. If you have a good solver, you're most of the way there.

The barrier to adoption has traditionally been that the interface required to work with complex solver code has not been exactly 'friendly' to mainstream users. This has changed dramatically in the last decade, with many vendors, typically from the 3D design side of the fence, having created applications that make it easy for designers and engineers to reuse their 3D design data.

At the core, it's the solver that counts in terms of accuracy of result and scope of capability. It'll give you much the same results, whether you're working at a command line level or using a nifty Windows-based interface. One of the kings of solver codes is Nastran, developed by NASA decades ago and now, through anti-competitive moves by the US government, effectively available to anyone through the Library of Congress.

While there are several implementations of Nastran, one company that has jumped all over the opportunity is NEi Software with its

» **Product: NEi Fusion**

» **Supplier:**  
**NEi Software**

**Price from £2,534**

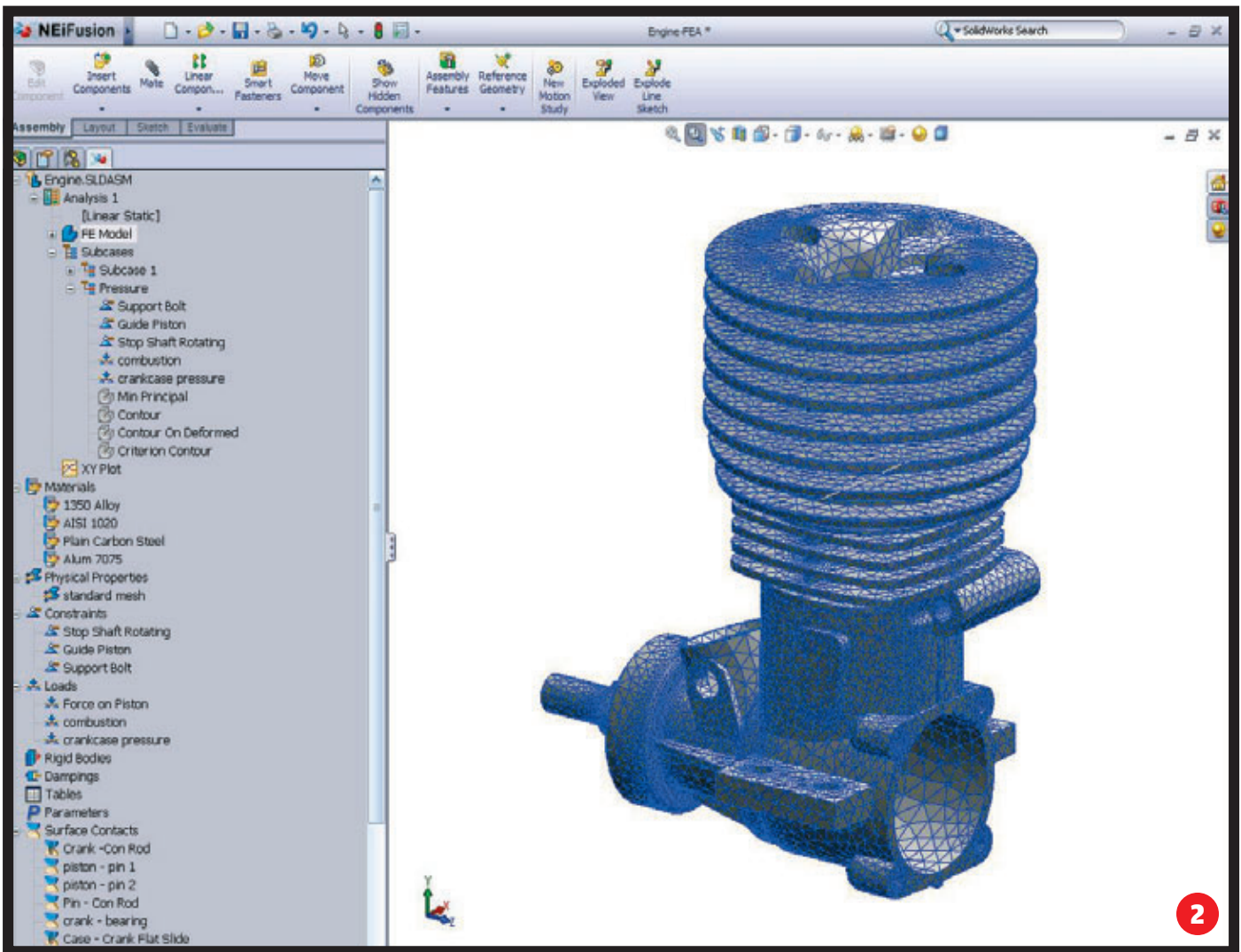
[www.neifusion.com](http://www.neifusion.com)  
[www.ssanalysis.co.uk](http://www.ssanalysis.co.uk)

**1 NEi Fusion combines ease of use and powerful geometry creation and manipulation tools that interact with the industry standard Nastran solver**

recently released NEi Fusion system.

Within the Nastran world, users typically need to find a pre/post processor that talks to the solver. This allows them to set-up the simulation case in a task specific way, communicate it to the solver and then, when complete, inspect the results. There are many flavours and types of pre/post processors that integrate with Nastran. Some are rather basic, some are geometry driven, while others give the expert analyst all the tools he needs.

NEi has built its pre/post processing tools directly on top of a rather well known modelling package called SolidWorks. It's a little known fact that SolidWorks is sold as an OEM license. Third party vendors acquire licenses to build their applications within it, so you buy it lock, stock and barrel, rather than as an add-on. So, that's the background, let's look at how NEi Fusion works and what it can do.



## SIMULATION TOOLSET

NEi Fusion provides a whole range of tools to set-up simulation studies, with material selection, meshing, boundary definition (loads and restraints). This is done using tools built directly into the SolidWorks interface, using a dedicated left-hand panel. This presents everything pertaining to a specific study in the familiar hierarchical tree, adapted for this purpose. Users are provided full control over their model and the inputs to the study, such as material definition (on a part by part basis), physical properties, constraints, loads, rigid bodies and damping and contact definition.

NEi Fusion makes full use of SolidWorks' ability to display, interact with and manipulate data. With the addition of FEA-specific tools, the combination is pretty compelling and there is a huge range of tools

**2 NEi Fusion allows users to mix and match element types to make use of the most appropriate method for each specific simulation**

available. Also, because models are based on a leading 3D modelling system, developed specifically for that purpose, simulation runs can take advantage of certain capabilities, almost for free. De-featuring or abstracting a model is a snap, either using SolidWorks' feature suppression or geometry manipulation tools.

NEi Fusion supports the various analysis and simulation processes of Nastran and there are two basic configurations. NEi Fusion Basic bundle gives the ability to simulate linear statics, modal analysis, buckling, pre-stress, and steady state heat transfer problems. The Expert package extends this with advanced dynamics, and non-linear capabilities for both structural analysis and transient heat transfer. While each of these is priced separately, in the case of the advanced options, it makes complete

sense to license only those technologies you have the requirement for.

Once the study is complete, next comes the crunch work, with Nastran working in the background to calculate the results. Nastran feeds back progress to a separate window and the user can inspect it as it calculates. Next comes the fun bit - extracting usable data from the study, on which to base decisions.

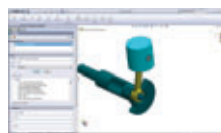
## POST PROCESSING AND VISUALISATION

Using a combination of graphics display and all the geometry manipulation tools available, users can create standard representations of their data. Contour plots are a snap to create and flexible in their creation. For more advanced work, textural-based data can be extracted and output in a spreadsheet

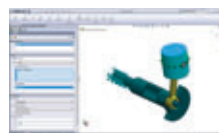
## NEI FUSION IN 5 STEPS



**1** Create geometry from scratch, import data or repurpose existing data using abstraction/de-featuring tools



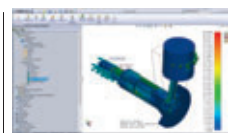
**2** Select materials from the database or key in properties and physical properties mesh type



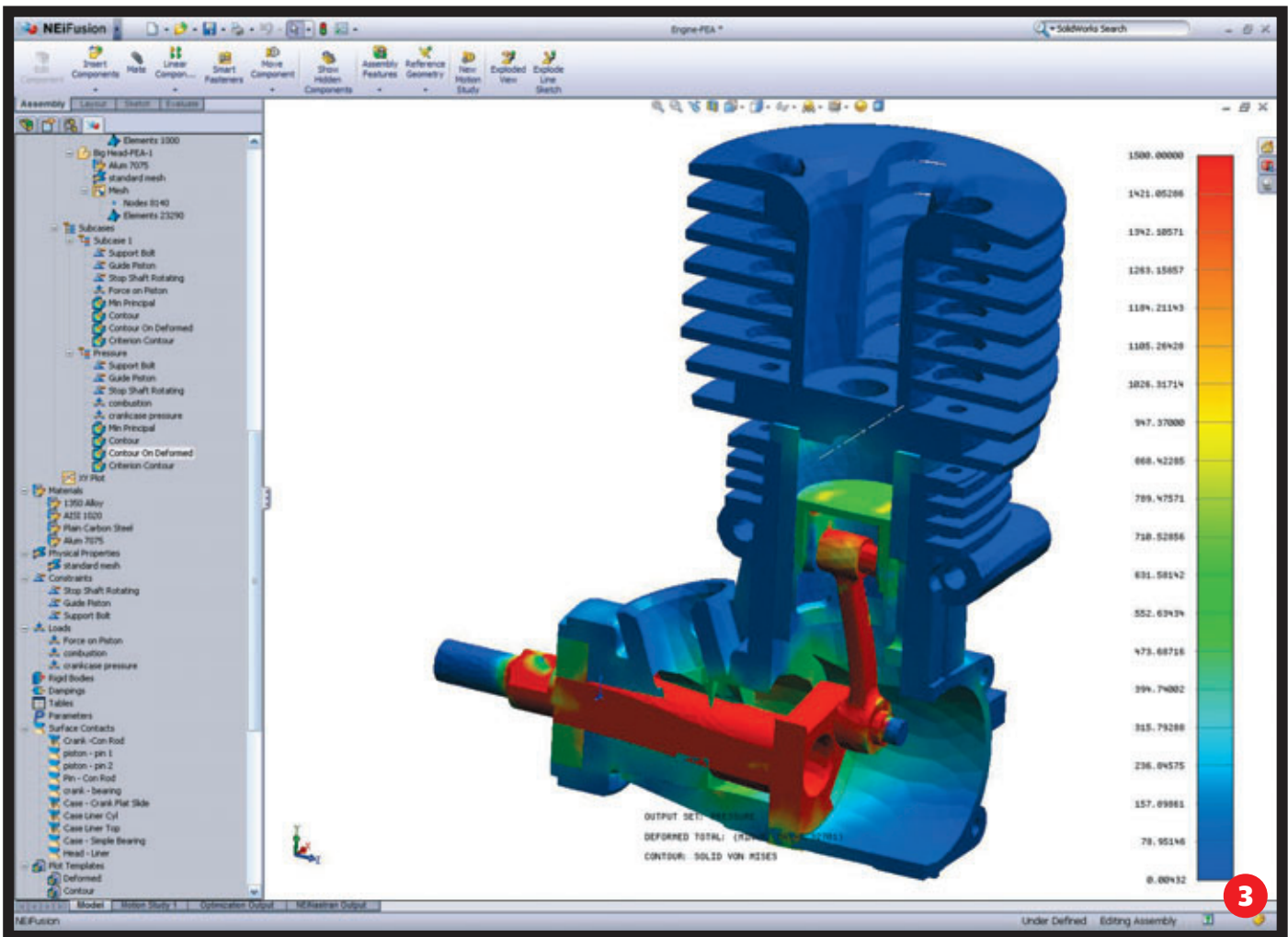
**3** Constrain geometry and apply loads



**4** Apply mesh and create contact between assembly components either manually or using the effective auto contact tools to handle the job



**5** After running the problem choose how to display the results



format. All in all, there's a complete set of tools for reporting on simulation and documenting all the findings of the study.

### INTEGRATING INTO THE NASTRAN COMMUNITY

There are many industries that rely on Nastran as the standard solver code and the ability to work within that environment can be key, whether the user is simply working on in-house projects or carrying out contract work. With a range of data translation options for both CAD (including all the standard formats and a range of native format options such as Pro/E, NX, Solid Edge, Inventor etc), the user also has the ability to work with Nastran-native data. Decks can be sent to any Nastran FE-based solver, whether that's NX Nastran or MSC Nastran and binary results files (in OP2 format) are also usable by all Nastran solvers and wide variety of post-processors.

3 **Visualisation of results is key. NEi Fusion uses the underlying geometry handling and display technology in SolidWorks, but brings a whole host of simulation-specific tools to help users dive in and inspect data**

### CONCLUSION

NEi Fusion is an impressive product. The team has combined two platforms (SolidWorks and Nastran) into a cohesive standalone product that provides the mainstream user with a set of tools that are eminently usable, rich in functionality and deep in their capability, with a geometry-handling platform that's second to very few. The result is a system that gives users the tools they need, on their terms, in an easy-to-use environment.

While the basic structural analysis tools are standard fare, where NEi Fusion gets interesting is in the deeper levels of functionality. The tools for optimisation are easy to use once the intelligent model required to drive it is complete. The composites analysis tools make something that could potentially be incredibly complex, much more streamlined to the process of design. A case in point is the impact analysis

tool. From a deceptively simple input set, under the hood the system is doing some incredibly complex mathematics, setting up surface contact between the projectile and part, determining the contact surfaces, calculating the contact duration and time steps needed to capture an accurate non-linear transient event, and determining the vibration characteristics of the colliding bodies - not something for the faint hearted if done manually.

NEi Fusion is an impressive selection of simulation tools that are based on a trusted and mature core technology in the form of Nastran and it's hard to fault it at all. If you're looking at either moving your simulation usage up a notch or have more advanced needs, then the system starts with the more basic functionality, but also provides a lot of head room in terms of scaling up usage to more advanced processes and analysis types.

### EXTENDING SPECIALIST CAPABILITY

While NEi Fusion has a rich set of capabilities, simply because it's a Nastran-based technology, there are some task- or process-specific simulation tools worth discussing. The first is the ability to create a parametrically-driven model and use that as the basis for iterative optimisation.

Users can define optimisation objectives to minimise, maximise or achieve specific targets for weight, stress, temperature, natural frequency or any other measurable factor. The ability to create multiple configurations of a family of parts, maybe a set of design options within a single

part or assembly file, then quickly reuse a single FEA set-up to evaluate the best of each holds great promise. Another is impact analysis. This is an incredibly complex process to simulate using manual methods to define all of the interactions between the various inputs,

constituent parts and physical phenomena. However, when the core concepts and principles are wrapped up into a bespoke tool for the job, the process becomes much easier to adopt. NEi Fusion has this in the form of Automated Impact Analysis (AIA). The input is simple once the geometry is

prepared and the user defines the projectile's initial velocity and acceleration and the system does the rest. The final thing to consider is composite simulation, something that's growing in a wide spread of industry sectors and mainstream simulation tools are starting to support it.

NEi Fusion allows the analysis of composites and laminated products and makes the process straightforward and less time consuming. These include easy definitions of ply lay-ups, plates and shell elements for composites, and an extensive list of supported failure models.