State of Thermal
Does simulation suit the needs of today’s thermal engineers?
Introduction

Last year, 6SigmaET launched The Heat is On, an in-depth study into the priorities and attitudes of electronics engineers around the world. This research found that despite engineers’ focus on product reliability, many were still failing to adequately manage the thermal performance of their designs.

The findings also highlighted that companies often leave thermal considerations until the final stages of their projects, with over a quarter not testing the thermal reliability of a design until after it is complete.

Building on these findings, we at 6SigmaET wanted to drill down into the specific processes of thermal analysis currently being used by today’s design engineers. To achieve this, we narrowed our approach to a group of 117 engineers who specifically work in thermal management. Of those 117, 110 were identified as using thermal simulation tools across their projects.

This report provides an insight into these thermal professionals, examining their attitudes towards thermal simulation, how easy it is for them to run simulations successfully and whether they have the right tools to support them. Through these questions, our State of Thermal report provides invaluable insight into the changing face of thermal analysis in 2017.

Who should read this report?

- Thermal engineers looking to explore the views and demands of their peers
- Manufacturers and businesses looking to drive efficiency across their designs
- Product designers looking to understand how thermal issues can damage their processes
- Those looking to invest in or explore new thermal simulation software
Our sample

This report incorporates research from 117 engineers with a focus on thermal management and design. The engineers were sourced from the database of Thermal News – a popular online magazine for those working in the thermal electronics industry.

Of the 117 engineers surveyed, 110 were identified as using thermal simulation products. These products included Icepak, Fluent, Flotherm, FloEFD, 6SigmaET, Solidworks Flow solutions and several other leading brands.

Thermal simulation users included in our study:

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<tr>
<th>Icepak</th>
<th>FlothermXT</th>
<th>Solidworks Flow Solutions</th>
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<tr>
<td>Fluent</td>
<td>FloEFD</td>
<td>AutoDesk CFD</td>
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<td>Flotherm</td>
<td>HeatDesigner</td>
<td>6SigmaET</td>
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The majority of thermal engineers are currently using simulation to analyse the impact of natural convection upon their designs. Within most industries this will be due to the fact that adding forced convection such as liquid cooling or fans simply isn’t possible due to the size and cost constraints.

There is also a significant number who are now attempting to work with transient analysis – examining how temperature may change over time (e.g. after additional components are switched on, fans fail, or power throttling occurs).

This type of analysis is significantly more complicated, involving much larger data sets. Clearly today’s thermal engineers aren’t holding back when it comes to their analyses, examining potential thermal issues in much more detail and expecting their hardware and simulation packages to keep up.
Despite the majority of those surveyed using thermal simulation tools, only 29% of thermal engineers claim to be completely satisfied with their current simulation packages. In many cases this comes down to a lack of documentation and support, with only 37% of engineers stating that they are completely satisfied with the support offered by their simulation provider, and only 20% claiming to be completely satisfied with the associated supporting documentation.

As will be explored later in this report, many engineers find their tools limited, difficult to understand and time consuming to use. Dissatisfaction also comes down to the cost involved in purchasing and maintaining a thermal simulation package, with nearly a quarter of engineers (24%) saying that they are either somewhat unsatisfied or completely unsatisfied with the cost of their current thermal simulation solution.

While cost is clearly an influencing factor, this may be due to the fact that engineers are unwilling to pay for something when they do not feel they are receiving the best possible results. As such, they may not feel they are receiving enough return on their investments – particularly if their personal usage only scratches the surface of what a simulation tool can do.
One of the biggest frustrations facing thermal simulation users is the time involved in importing CAD, building models and solving. According to our research, only 37% of engineers spend less than an hour building their models, while 30% have to spend over a day. Once this design stage is complete, 39% spend more than an hour defining properties while 23% must spend over an hour setting boundary conditions. 41% also say that they will typically spend over an hour gridding their design while 10% will spend more than a day.

All of these tasks add significantly to the total simulation time, and that’s before engineers have even attempted to solve their designs – the stage that is typically perceived as one of the slowest in the simulation process.

While accurate simulation will never be a quick task, the reality is that many engineers are spending longer than necessary as a result of slow or poorly designed thermal simulation software packages.

As just one example, 66% of thermal engineers spend up to a day or more solving their simulations – and yet 14% say that they can do this in under 30 minutes. Similarly, 39% must spend over an hour importing CAD data, while 24% claim to be able to run the same task in under 10 minutes.

These discrepancies highlight the significant differences in usability and solve time offered by different thermal simulation packages.

Rohde & Schwarz: A Time to Solution Comparison

In a side-by-side comparison conducted by Rohde & Schwarz, 6SigmaET was found to provide faster preparation time, faster pre-processing and faster solving times than a comparable thermal simulation software. This meant a total increase in efficiency of 35%.
It's complicated

In many cases the additional time taken to perform simulation tasks is not down to slow software, but rather a result of unnecessary complexity and poor user interfaces.

Of those surveyed, nearly a fifth (18%) struggle when it comes to the gridding/meshing of their designs. This may be down to a lack of automation across many thermal simulation suites, with engineers often being forced to repeatedly alter their grids manually in order to improve the accuracy of their simulations. Currently, 61% of engineers must modify their grids in order to increase accuracy, while 34% claim that they must regularly create a grid from scratch.

While there are clearly time issues throughout the simulation process, the task of building and developing component models is generally considered the most straightforward part. 69% of thermal engineers say that they find it easy to build models, while 71% find it either easy or very easy to set boundary conditions for their designs. That said, 51% would still like to speed up the model creation process.
A hard time with hardware

Thermal engineers are also struggling to adopt the hardware necessary to support today’s resource-intensive thermal simulation software packages. Given the nature of the coupled non-linear equations that must be solved, most software requires a significant amount of processing power in order to generate accurate results quickly.

As it stands, 22% of thermal engineers say that their organisations are not able to keep up with the hardware requirements needed to run a thermal simulation. As a result, 24% find themselves having to compromise on the accuracy of their designs due to hardware limitations.

While there is upfront expense involved in providing this hardware for simulation. 36% of respondents state that – rather than investing in expensive on-premises hardware – their organisations would benefit from being able to solve their thermal designs via the cloud. As it stands however, only 2% of thermal engineers currently use the cloud for solving their simulations.

Solving in the cloud

With any thermal simulation, significant computing power is required to solve the complex CFD (computational fluid dynamics) equations used to calculate temperature and airflow.

Traditionally, this has required a substantial up-front investment in high performance computing hardware. By taking advantage of cloud computing platforms however, thermal engineers can significantly reduce their hardware requirements and instead “pay as you solve”.

At 6SigmaET we have partnered with high performance cloud computing platform Rescale specifically to help engineers overcome hardware challenges. Through this partnership 6SigmaET users gain access to as much as 1,400 petaflops of computing power delivered via Rescale’s 30 data centers and over 8 million servers.
Despite their frustrations, our findings suggest that thermal engineers do in fact know what they want from simulation software. According to our research, 63% of thermal engineers would like to improve the accuracy of their simulations, while 46% want to find ways to speed up solve times. 41% would also like to see greater automation in the optimisation of their designs.
Making the switch

As this analysis has shown, today’s thermal engineers are quite open about the flaws and frustrations that are built into their existing thermal simulation packages. From slow solve times to complex user interfaces, limited automation to a lack of cloud integration. And yet, despite this fact, most engineers remain wedded to their existing thermal simulation platforms.

Of those surveyed, 40% have never switched to an alternative simulation tool, while a further 18% last switched tools more than 3 years ago.

For some this may be due to a reluctance to disrupt their existing workflow in the short term, for most however it is simply a matter of habit. As a result, many engineers are left believing that their legacy thermal simulation tools are the best that the market has to offer – potentially costing their organisation both time and money in the long term.

With so many engineers being forced to sacrifice accuracy as a result of hardware and software limitations, it’s important to explore all available options. Without trialing other tools, thermal engineers will never be certain that their existing approach to simulation is guaranteeing maximum reliability for their end products and designs.

This is not only bad news for engineers and manufacturers, it’s bad news for the end customer.

Despite 71% of thermal engineers not being completely satisfied with their simulation package, 60% haven't switched provider in over 3 years.
Conclusion: Time for a change?

Demands on thermal engineers are growing with increased complexity, miniaturization and increasingly urgent time and cost pressures.

Thermal engineers need reliable simulation tools that can assist them by providing accurate results quickly. These tools must provide a clear and intuitive user interface, rapid design and solve times on a wide variety of hardware, including the ability to offload complex analysis to the cloud.

As it stands however, many engineers are left relying on drastically out of date simulation software – software which often has not been replaced or significantly updated for years. As a result, many engineers are spending too long on thermal simulation and not getting the detailed results they require.

What is needed is for these engineers and businesses to think beyond their legacy thermal simulation packages, and look to work with vendors that continue to innovate and push the boundaries of thermal simulation capabilities.
About 6SigmaET

This report was commissioned by 6SigmaET, a leading provider of innovative thermal simulation solutions. The 6SigmaET platform has been identified as one of the fastest thermal simulation software suites in the electronics sector, using a combination of cloud solving, unstructured gridding and intelligent automation to generate thermal simulations in a fraction of the time of older, legacy platforms.

To find out more about how 6SigmaET can benefit your business, visit http://www.6sigmaet.info/whyswitch