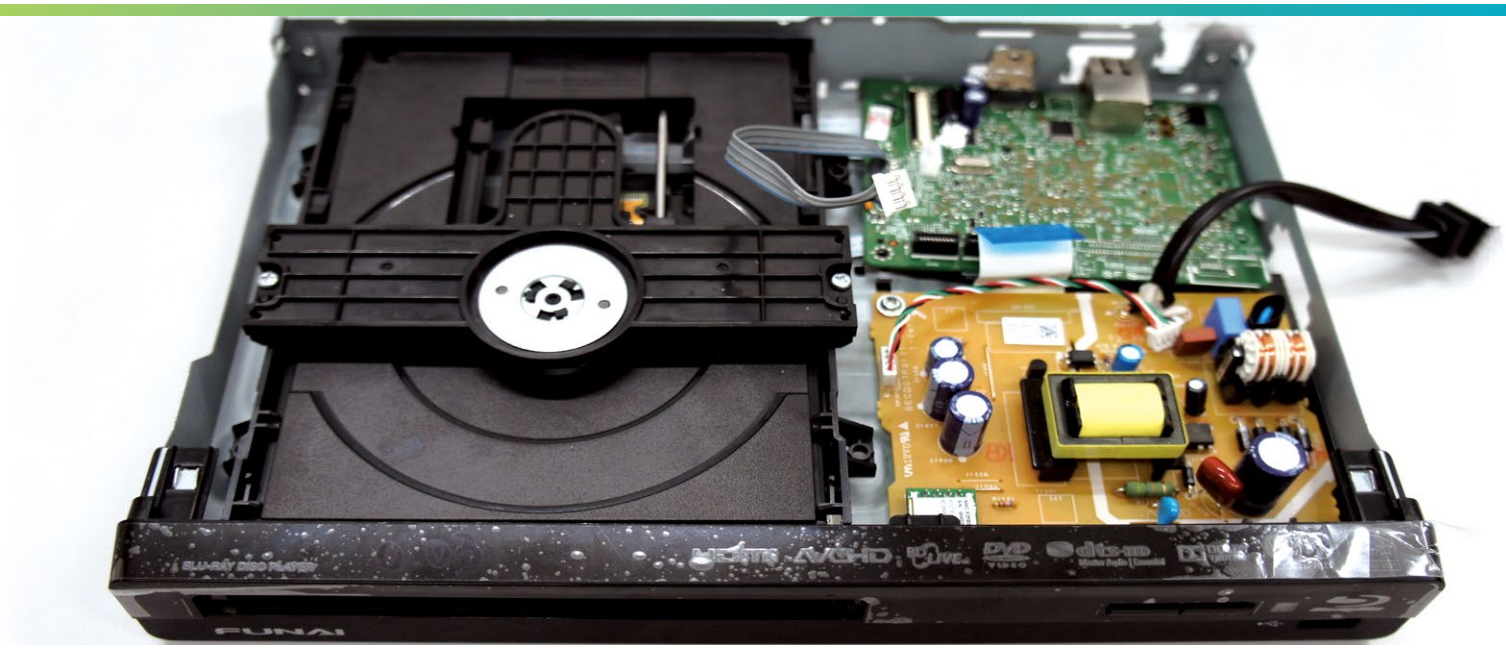
FUNAI ELECTRIC CO., LTD.

Thermal analysis tool enables low-cost, fast-to-market product development and manufacturing



Cradle CFD
Case study interview

Funai Electric engineers and manufactures low cost, high quality electronics products. Their success surpassing the fierce competition in their industry is firmly linked to ambitious implementation of thermal analysis for product development and product issue troubleshooting. SC/Tetra HPC (High Performance Computing) solver is Funai Electric's thermal analysis tool of choice and has been instrumental in helping the company achieve success.

Funai Electric is a general consumer appliance manufacturer that designs, develops and manufactures electronic products such as video equipment, LCD TV and Blu-ray/DVD players, printers for home and office use, and other telecommunications devices and ancillary computer equipment. The company serves as an original equipment manufacturer (OEM) for other companies and also manufactures products under their own brands. These products are widely distributed throughout North America, South America, Europe, Asia, and other parts of the world.

Funai Electric has gained substantial credibility in the industry, as well as considerable market share, since being founded in 1961. Their remarkable ability to deliver low price, high quality products on schedule is the key to their success.

Head office of Funai Electric Co., Ltd. (Osaka, Japan)

FUNAI ELECTRIC CO., LTD.

www.funai.jp/en/

Established	August 1961
Business	Manufacturing of video equipment, electrical appliances (DVD/Blu-ray players and recorders, IT devices and other related products)
CEO	Yoshikazu Uemura
Head office location	Daito-shi, Osaka, Japan
Number of employees	953 (as of March 31, 2014)
Capital	Approx. 31 billion JPY (as of March 31, 2014)

Thermal analysis of a high-heat-source projector

Funai Electric first started applying thermal analysis software to develop a projector, whose light source generated large amounts of heat. Before using thermal analysis software, if a problem occurred during prototype production or during the temperature measurement tests, determining a solution required going back to the design and repeatedly making adjustments. Although Funai Electric knew they needed an alternative to this time-consuming and inefficient process, their engineers were used to working this way. They relied on estimations based on the previous data and experience, and this hindered them from making fundamental improvements. At the same time, Funai Electric customers demanded shorter development time and product miniaturization. This led Funai Electric to consider introducing CFD analysis.

SC/Tetra is a Perfect CFD Tool for development

One engineer at Funai Electric explains that the company decided to use SC/Tetra CFD software primarily because “the software was entirely developed by a reliable firm, who provided fast and extensive support.” Before making the final decision, Funai Electric requested each software vendor to present results from their software to compare performance and functionalities. The highly accurate results from the benchmark model analysis performed by Cradle convinced Funai Electric engineers that SC/Tetra was a very good choice. They were also well satisfied with the efficient communication with the Cradle staffs, noting that their questions were thoroughly answered in a short amount of time.

While Funai Electric’s main reason for using thermal analysis software was to design electronic devices,

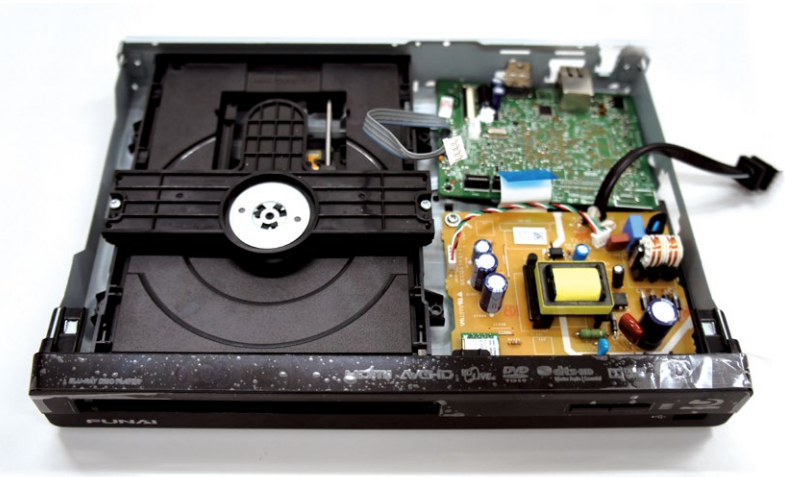


Figure 1: inside a DVD player

Main product range of Funai Electric

they decided to use SC/Tetra instead of HeatDesigner, a structured mesh thermal analysis software specially designed for electronics cooling. SC/Tetra enabled the Funai Electric engineers to create intricate, highly detailed models. Engineers could analyze their rotating disk drive products such as CD-RW and DVD drives for PC and video equipment. They were able to represent fans and blowers with a high degree of precision and perform the associated system analyses. After discussing software options with Cradle, Funai Electric decided that SC/Tetra provided the greatest amount of modeling flexibility.

Software that meets the demand for parallel computing

When Funai Electric began using SC/Tetra, calculation time could be very long because of the high complexity needed to model the area around the projector lamp. This complexity imposed considerable computation load, and modeling the details of the rest of the projector further increased the computation time and burden. Upgrading computer hardware shortened the analysis time but only by a modest amount. In some cases, complicated models from the design team could still take over 200 hours to converge. This left no room in the schedule to consider alternative design concepts. The problem was much worse during the early phase of SC/Tetra introduction, when the geometry models contained too much detail. Requiring 200 hours to obtain a solution disappointed the engineers, who voiced the need for faster turnaround. To solve this issue, Funai Electric introduced SC/Tetra HPC solver with parallel computing. Parallel computing with 24 processors reduced computation time significantly.

Applying SC/Tetra to the design of DVD players

For the design of a DVD player, Funai Electric assigned two CFD specialists to perform CFD analyses during the early phases of the product development process and to also use it for troubleshooting. During the development of the DVD player, the competition in the marketplace for this product was intense in terms of price and device performance. Funai Electric was also under the pressure to come up with an advanced design. To achieve this, the design team suggested eliminating the small fan often used in the player, to help reduce cost and noise, and enhance product competitiveness. The design and analysis teams worked closely to find a way to accomplish the goal.

Airflow is induced inside the DVD player even without the fan, because of the rotating disc. The challenge was to find a way to use this airflow to cool the IC chip. Funai Electric engineers first considered whether a design structure without heat-sinks was feasible. They arranged the chassis to be in contact with the IC chip by making a dent, which functioned as substitute heat-sinks that dissipated the heat to outer chassis. Another design concept involved drilling a hole in the chassis to let the air generated by disc rotation pass through. The team also considered adding walls to the area where airflow was not necessary and modifying the the inner structure to direct more airflow towards the IC chip. By using CFD to evaluate the design concepts, Funai Electric engineers found that the chassis with a hole for the air to pass through, in combination with making the chassis from highly heat-conductive aluminum, was most efficient.

This illustrates how Funai Electric benefitted from using SC/Tetra during the early design phase. The development time took less than six months by applying a model derived from a previous project. Design modifications were accommodated by cooperative exchanges between the design and analysis departments. This was followed by prototype testing by the design team, and finally, the trial production. Ultimately, Funai Electric succeeded in reducing cost, prototype production, and overall development time.

Planning countermeasures against heat

Before introducing thermal analysis into the design process, Funai Electric engineers had to repeat the prototype test and design phase many times to optimize the design. CFD analysis quickened the prototyping process by enabling the engineers to visualize places inside the DVD player that could not be easily observed in the real world. The company acknowledged the usefulness of CFD because they are now able to only make small adjustments to the components to solve the design problems. While the engineering team constantly faces new challenges such as the increase in heat generation per unit caused by the miniaturization of IC chips, the team is confident in coming up with a solution by using CFD early in the design process. They are encouraged because using CFD to evaluate conceptual designs early in the process helps them make quick decisions and actions as they work toward the best solution.

While Funai Electric is quite satisfied with the way they have used CFD for conceptual design, they realize that clearly identifying the benefits can still be challenging. Using CFD early in the design phase to identify the most promising designs eliminates problems that would normally be manifest later in the process. Fewer serious thermal problems arise during the prototyping phase because they were recognized and eliminated earlier in the process. As a result, the benefits of using CFD in the design process cannot be recognized or quantified easily. On the other hand, the effectiveness of measures derived from the CFD analysis taken in response to product issues can be observed more clearly. The analysis verifies the cause of the problems and helps identify the best solution. Funai Electric's challenges in trying to quantify the benefits of CFD are similar to other companies. Nevertheless, their experiences suggest that more consideration is necessary to fully capture and quantify the benefits from applying thermal analysis software.

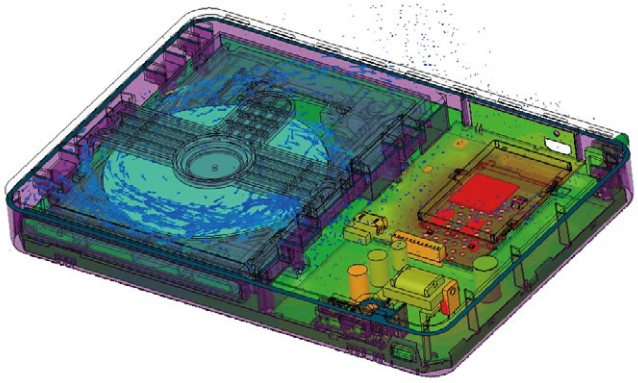


Figure 2: analysis results from a DVD player

Boosting the product performance using SC/Tetra

While Funai Electric has developed a high degree of proficiency using CFD, their ambition to do even more knows no limit. Not only are they eager to apply SC/Tetra to more new product development efforts especially in the early design phase, they also want to improve the accuracy of the results. This includes improving the modeling accuracy and applying the appropriate equations for turbulent flows. The impact of improving accuracy will be less when using CFD for conceptual design in comparison to the detailed models needed to solve production issues. This is why Funai Electric is intent on achieving high accuracy, with one of the first steps being to assess the turbulent flow models in SC/Tetra, and to identify which ones work the best and why.

In recent years, Funai Electric has also become aware of the increasing importance of coupling analysis processes as they continued to develop their diverse line of products. Coupling of structural and fluid analysis is an example, and they are very interested in determining how fluid pressure and flow rate affect the deformation of the structure.

Another result from the implementation of CFD is reduction in the number of fluid related experiments as they begin to be replaced by CFD analysis. Engineers agree that fluid experiments require significant preparation and post clean-up. These can be minimized by using CFD to reduce the number of tests and increase the overall efficiency.

Anticipating further progress of SC/Tetra

CFD specialists at Funai Electric expect that Cradle software will continue to help them enhance the technology in their products and help them develop products that are widely used and highly anticipated around the globe. They further note that they would like Cradle to upgrade the coupling function in their software and to continue to strengthen their ability to offer excellent consultation and support. Funai Electric's steady progress and successful implementation of SC/Tetra into their product development process will help them continue to manufacture high quality products for global consumers.

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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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