

## Apparel • Footwear and accessories

### ASICS

Renowned manufacturer of sports shoes maintains leading-edge position through continuous pursuit of performance excellence; simulation early in the product development process provides distinct advantage

#### Product

Femap

#### Business challenges

Establish shoe development approach that facilitates design superiority and high performance

Make good decisions regarding design direction early on

Integrate biomechanics data into product development process

#### Keys to success

Deploy easy-to-use analysis tools for use by non-CAE specialists, including providing appropriate education and training

Utilize subjective biomechanical metrics in shoe design process

Use CAE tools in the early phases of development

Leverage simulation for communication and promotional purposes

Develop and deploy engineering methodologies to quantify product features



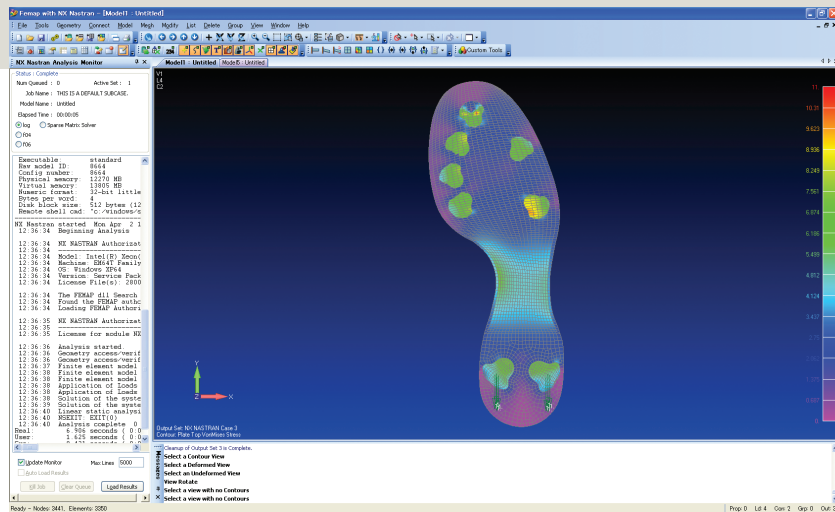
#### CAE facilitates design direction and prototype reduction, cutting time for new product development

##### Continuous commitment to CAE for a quarter of a century

ASICS Corporation, Institute of Sport Science (ASICS) is very popular in the sports footwear market. This includes both the general consumer and running shoe segments, where ASICS is among the market leaders. The popularity of ASICS shoes is largely based on their superior functionality, which can be directly attributed to

the company's continuous efforts to improve shoe performance.

One of the major contributors to improved shoe performance has been the aggressive use of computer-aided engineering (CAE). At ASICS, serious commitment to simulation began around 1987. For 25 years, ASICS professionals – both CAE specialists and other engineers/researchers – have actively utilized various analysis tools. Among these tools, the most significant contributor to performance enhancement has been the use of Femap™ software with NX™ Nastran® software.



## Results

Notably reduced number of physical prototypes

Slashed time needed for new product development by 30 to 35 percent

Cut CO<sub>2</sub> production emissions (due to shorter overall development process)

Utilizing CAE analysis results in the form of images and movies for organizational collaboration and product marketing purposes

The CAE effort is led by Dr. Tsuyoshi Nishiwaki, Fellow and senior general manager of ASICS Institute of Sport Science. Since joining ASICS, Dr. Nishiwaki has strived to implement and deploy the best CAE tools across the product development process. Before devoting his time to shoe development processes, Dr. Nishiwaki worked on analyzing sporting goods, such as tennis rackets. Dr. Nishiwaki is not only experienced in the use of CAE software, he has personally developed a numerical model that represents the mechanical properties of composite materials.

## CAE as a decision-making tool for development direction

Through experience, Dr. Nishiwaki has observed that CAE software is a great tool

for decision-making across a number of areas, especially for development direction. He points out, for example, that because of the use of 3D computer-aided design (CAD) in conjunction with Femap with NX Nastran, ASICS has reduced and continues to reduce physical prototypes per project. He also notes that reducing CO<sub>2</sub> emissions is now becoming an important issue at the corporate level, as well as for virtually every manufacturer today. By using CAE early in the development cycle, the production of physical prototypes is significantly reduced, as are CO<sub>2</sub> emissions. “Using CAE effectively to decide product development direction, we estimate we are shortening turnaround by 30 to 35 percent for general development projects,” says Dr. Nishiwaki.

Many CAE users focus on how well analysis results match with experimental results. According to Dr. Nishiwaki, for purposes of shoe design, it is a rare case to have exactly the same results. To do so, all of the required information, such as material properties, constraints and loads must be completely known. This is particularly true for products like sports shoes, which require factoring in certain physical conditions of the human body, although much of that information is highly variable or unknown. For example, muscle flexibility/stiffness often varies as a person’s mental state changes. So even if just one of these characteristics is unknown, that often means that one cannot obtain a highly accurate result.

Nevertheless, Dr. Nishiwaki emphasizes how critical it is to use CAE tools to capture the impact of design on shoe performance, explaining that simulation can provide special insight on the design of a shoe’s sole, enabling important decision-making data regarding overall performance to be captured in the early phases of development. According to Dr. Nishiwaki, it is just this type of use of Femap with NX Nastran that has enabled ASICS to reduce product development time by 30 to 35 percent.

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Dr. Tsuyoshi Nishiwaki  
Fellow  
Senior General Manager  
ASICS Corporation  
Institute of Sport Science

### Using subjective metrics to improve objective performance

When Dr. Nishiwaki began his work on sports footwear development, he soon tackled the issue of leveraging subjective metrics using CAE. "Although quite a few biomechanics professionals have been researching human body movement with respect to shoes, these findings weren't leveraged to improve the shoe development process," says Dr. Nishiwaki.

To quantify performance metrics that could only be evaluated in physical ways in the past, ASICS established eight domains of functionally: cushioning, stability, flexibility, fitting, durability, grip, weight and ventilation. ASICS then established metrics within each domain through experiments and hypotheses. For example, to establish metrics for cushioning properties, ASICS hypothesized that such properties are tightly linked to the acceleration of the shin. Through a series of experiments, the company found that when the sole absorbs low frequency waves, the shoes have better shock-absorbing characteristics. Moreover, with that knowledge in hand, ASICS set about to determine specific cushioning metrics using CAE.

"The design process for shoes is the same, whether it's for a professional athlete or a casual jogger," says Dr. Nishiwaki, pointing out, "Actually, shoes for the casual jogger

have more performance features." According to Dr. Nishiwaki, shoes have two major roles. One is to improve the performance of the user; the other is to protect the user from injury. For the professional athlete, the second role, protection, is secondary. While protection is meritorious, a professional athlete's No. 1 priority is to improve performance. However, for the casual athlete or young person first trying sports, protection from injury is very important. Moreover, sports shoes for general consumers must serve highly diverse needs, so they must perform well for most individuals.

### High analysis functionality + extraordinary ease-of-use = efficient product development

Dr. Nishiwaki notes that the use of CAE tools by all research and development (R&D) professionals – not just analytical specialists – is essential for efficient product development. However, he adds that ease-of-use is critical to engaging the software's use by engineers and it is here that Femap with NX Nastran truly stands out, because it's a powerful analysis tool that's easy to navigate and satisfies the requirements of a broad spectrum of users.

"Femap with NX Nastran is very easy to use, even if an engineer has little to no experience using numerical analysis tools," says Dr. Nishiwaki. "After one or two days

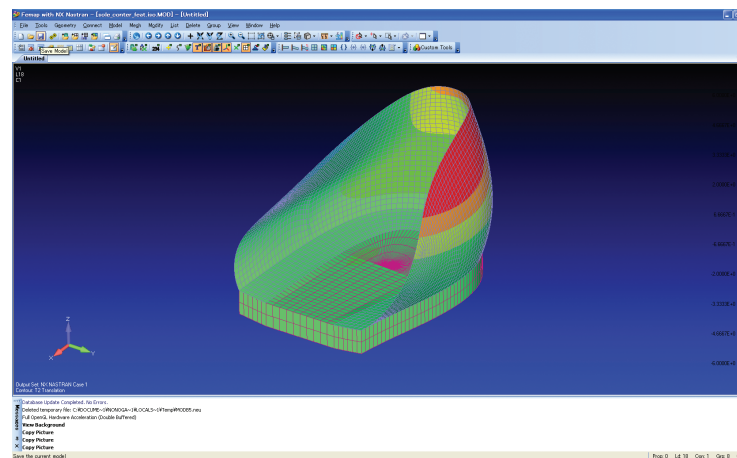


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## Solutions/Services

Femap with NX Nastran  
[www.siemens.com/plm/femap](http://www.siemens.com/plm/femap)

## Customer's primary business

ASICS manufactures and sells sports and leisure goods.  
[www.asics.com](http://www.asics.com)

## Customer location

Hyogo  
Japan

**"Femap with NX Nastran is very easy to use, even if an engineer has little to no experience using numerical analysis tools."**

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of training, an engineer can start utilizing CAE on his own. Even a complete novice, an engineer with absolutely no CAE experience, can easily start numerical analysis by importing geometry from 3D CAD software, creating mesh using auto-mesh functionality, then analyzing the optimal depth of grooves in a sole and positioning of gels for shock absorption."

Dr. Nishiwaki points out that such ease-of-use is commonly associated with low functionality in analysis software, but that's simply not the case with Femap with NX Nastran. "There are no issues in convergence; enhancement of the code for non-linear analysis is exactly as we wished. The solution even has good enough functionality for appropriate use by numerical analysis experts, and we expect the software will get even better for such applications with subsequent releases. We are quite satisfied with the well-balanced functionality and usability of the software. Femap with NX Nastran has helped us create a more efficient product development process. It is up to us to determine how much we make further use of the software for competitive advantage."

Indeed, ASICS is extending the use of Femap with NX Nastran. It is now deploying the software to its product designers. ASICS excels in terms of shoe performance; however, Dr. Nishiwaki notes that outstanding design is equally essential, particularly for running shoes for the general consumer. "No matter how superior a pair of shoes may be in terms of performance, unless the shoes have high appeal from a design perspective, the reality is, the shoes will not have strong marketability," he says. "To develop shoes that satisfy both design and functional requirements, and to develop the best products, we feel that use of analysis tools by our product



designers is fundamental to improving our best practices. We are deploying Femap with NX Nastran for this role."

## Analysis software facilitates communication, marketing

Effective communication between engineers and nonengineers across the product development organization has grown since deploying Femap with NX Nastran. Even communication with consumers has improved. "It's phenomenal...we are now using results from numerical analysis in conjunction with experimental data for promotional purposes, and it's a valuable asset," says Dr. Nishiwaki. "By leveraging numerical analyses, the development process can be described in the form of animation. Now, even people unfamiliar with the technology can understand our shoe development process, which helps them understand the science and art behind our ASICS brand. Such content is already used in sales meetings with ASICS distributors and representatives, and even at public seminars for general consumers."

Ease-of-use and superior capabilities that satisfy even numerical analysis experts represent the distinctive attributes of Femap with NX Nastran. Moreover, these attributes are helping ASICS apply CAE across numerous development domains and projects. The results are valuable benefits at the front-end of design, especially from team members who don't specialize in simulation.

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