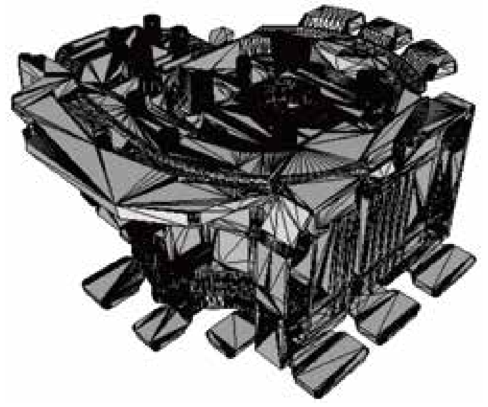
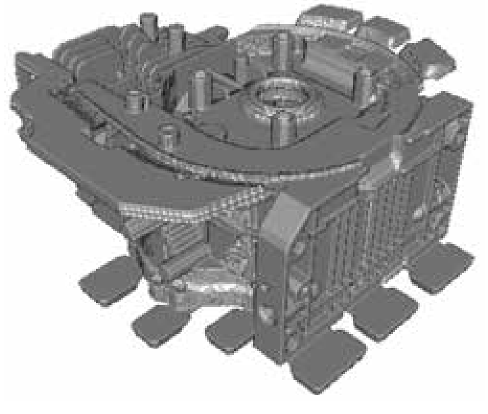
ADSTEFAN

Pre-processor

Loading of CAD data, creation of 3-D shape data, and input of analysis conditions can all be performed easily. Automatic element discretization functions also allow elements to be generated easily and at high speed and stability, without depending on an operator's technical skill.



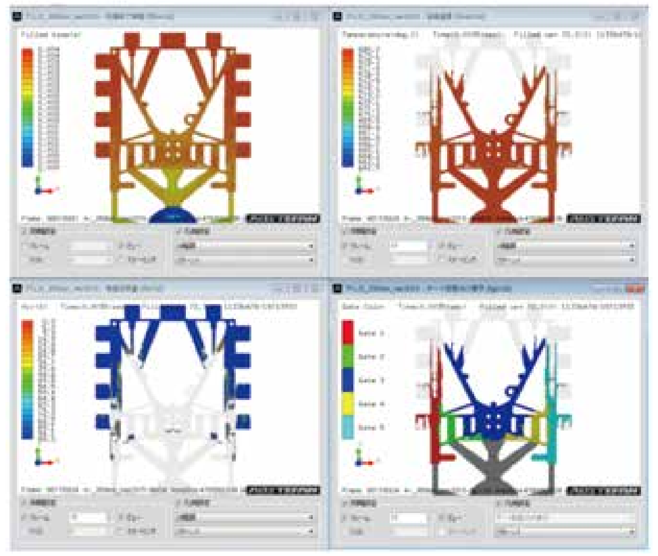
STL shape drawing



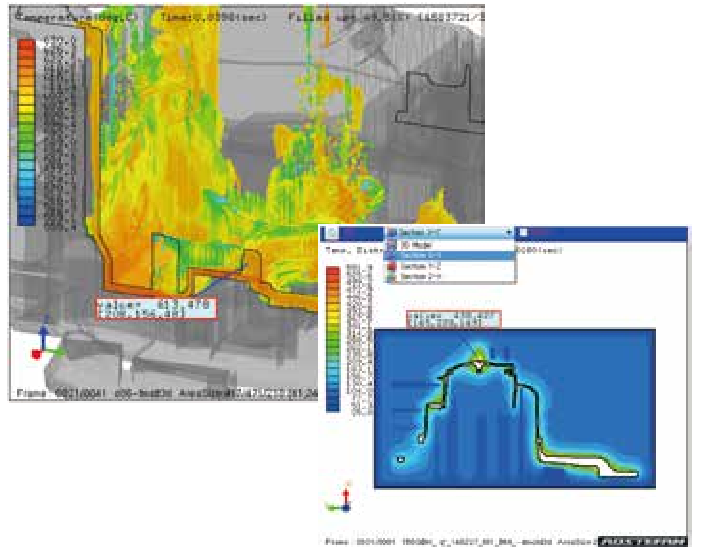
ADSTEFAN shape drawing

Post-processor

- **Fluid flow analysis result display**
  Temperature, filling ratio, velocity, flow rate, pressure, vorticity, volume of entrapment air, ratio of remaining air, flow line defects, color-coded display by gates, entrapment markers, gas markers, gas volume, maximum air pressure, etc.
- **Solidification analysis result display**
  Distribution of solidus ratio, casting and die temperatures, corrected temperature gradients, cooling rate, temperature gradients, degree of soundness, graphite grain numbers, solidification starting time, solidification ending time, pressure, cooling rate between 2 temperatures, etc.
- Marker display, vector display, contour line display, graph display, molten metal volume display, generation of various types of animation files, output of reports, printing



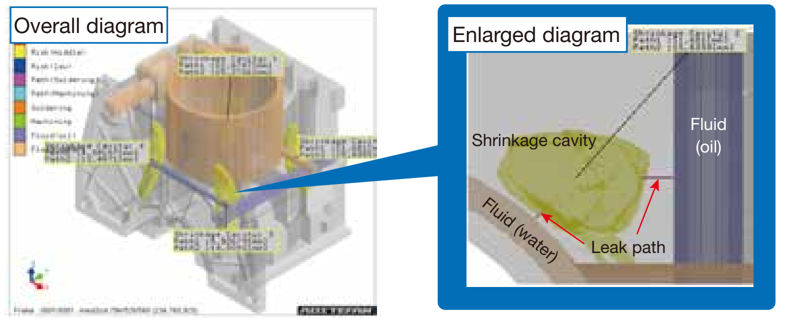
Display of multiple results



Acquisition of analysis result values through mouse-click operation

▶ Leak Prediction

Through the application of patents by NISSAN MOTOR CO., LTD., the degree of risk for leakage of a fluid (such as water or oil) in the cooling channel to the exterior through internal defects can be predicted.



▶ Macrostructure Prediction Analysis

Crystalline shape macrostructures (equiaxed crystals, columnar crystals) generated during solidification can be predicted.

▶ Continuous Casting Analysis

Solidification processes occurring during continuous casting can be analyzed.

▶ Heat Treatment Analysis

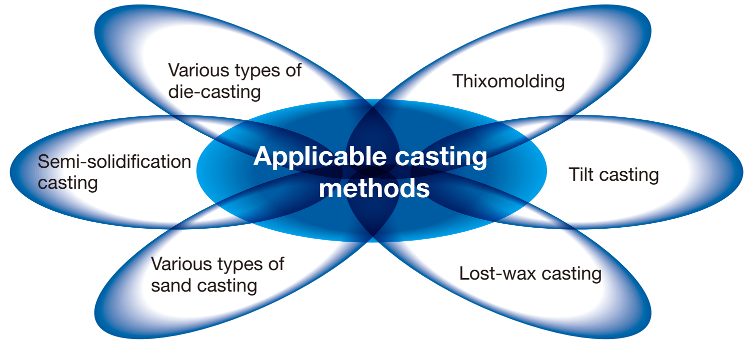
Temperature changes in materials subject to heat treatment are predicted.

▶ ESR Analysis

Laminar solidification forms occurring during ingot production can be modeled and analyzed.

▶ Solidification Material Property Module

The functions of JMatPro are used to calculate the values of physical properties, thermodynamic properties, and mechanical properties of metallic alloys required for analysis using ADSTEFAN, from their chemical components.



Simulation software created together with users

Expanding the partnership between industry and academia that has been cultivated so that it further includes users, opinions received from our customers at user meetings and technical seminars, which serve as opportunities for technicians using ADSTEFAN to exchange information with each other, are reflected in the form of new topics for ADSTEFAN's development.
ADSTEFAN's greatest strength is that it is simulation software created together with its users.

ADSTEFAN user meeting

Technical seminar (in Thailand)

■ **For inquiries regarding ADSTEFAN:**

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- ADSTEFAN homepage: http://www.adstefan.com

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HITACHI
Inspire the Next

Casting Simulation System

ADSTEFAN

The name ADSTEAN has its origins in the Stefan Study Group, a collaborative initiative between industry and academia originating at Tohoku University.
"Stefan" refers to Austrian physicist known for the Stefan-Boltzmann Law, Josef Stefan(1825-1893), whose name the group borrowed in recognition of his work.
Josef Stefan's achievements in the filed of thermal radiation are well known.
His research on the solidification of ice also makes him a pioneer in the filed of solidification analysis.
At the same time, the name Stefan also secretly incorporates the last initials of the study group's two lead researchers, Prof. Eisuke Niyama and Prof. Koichi Anzai.
When the technology from the study group's research was transferred to Hitachi to be commercialized, the letters AD, for "advanced," were added to produce the name ADSTEFAN.
While the ADSTEFAN logo is modeled on the letter A, it also represents the character used in Japanese to write the word "person"(hito).
That's because ADSTEFAN has always been, and always will be, person-centered in its development and support.
"Giving shape to people's ideas" that's the guiding policy behind ADSTEFAN's development..

Continually evolving, ADSTEFAN can create new values for casting

ADSTEFAN

Cost, time, and defects: ADSTEFAN can eliminate all forms of waste simply, quickly, and accurately.

"ADSTEFAN" is a CAE tool for design support, which can analyze the status of molten metal entering dies as well as its solidification processes, making such data readily visible so that defects in castings can be avoided at the early stages of design. This can then contribute to reduced trial castings, shorter production periods, and lower costs.

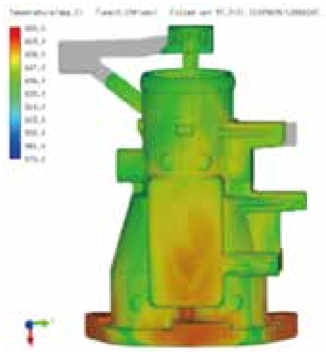
Establishing reliability

The know-how of experienced technicians from over 30 casting companies was gathered together in Tohoku University's cooperative industry-academia project, the "Casting CAE Research Society (Stefan Group)". After the passage of roughly 7 years, the fruits of the society's research and development were made into a commercial product through Tohoku Techno Arch Co., Ltd., a Technology Licensing Organization (TLO), to become a highly-reliable casting simulation system.

▶ Fluid Flow Analysis

The flow of molten metal poured into dies can be analyzed. Its filling status, pressure, temperature changes, and other parameters can be simulated, enabling optimal plans to be designed.

Casting product



Fluid flow analysis (misrun)

▶ Fluid Flow Analysis of Gas-Liquid Two-Phase Flow

Since analysis is linked with the movement of air and molten metal, it can be used to optimize reduced-pressure casting or vacuum casting. Analysis to reduce blowholes can also be performed using increased-pressure analysis.

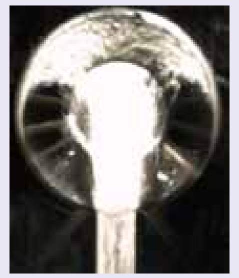
▶ Analysis of Molten Metal Behavior Inside Sleeves

Analysis is performed to determine how molten metal inside sleeves is injected depending on plunger movement. The entire process from pouring to injection to filling into cavities can be analyzed seamlessly.

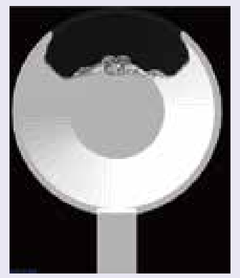
▶ High-Precision Fluid Flow Analysis

The straightness of flow along curved surfaces, which the finite difference method had been considered unsuitable for, has been greatly improved. Analysis can be applied to both blended elements and regular elements, and high-precision analysis can be achieved for blended elements, even with rough meshes. For regular elements, analysis is performed using the CIP method instead of the Navier-Stokes equations, increasing the precision of flow along curved surfaces.

Experimental results for water model

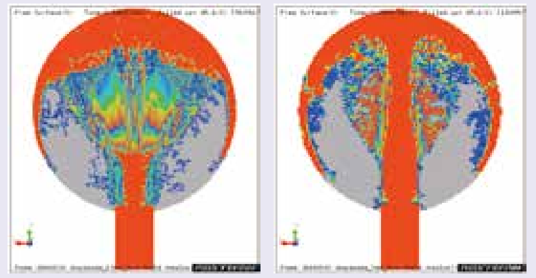


Analysis results for standard fluid flow



Thickness direction: 7 elements
Mesh number: 18,300,000

Analysis results for high-precision fluid flow (blended elements)



Thickness direction: 5 elements
Mesh number: 4,220,000

Thickness direction: 2.5 elements
Mesh number: 670,000

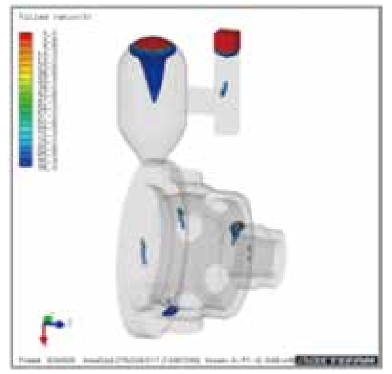
▶ Solidification Analysis

The solidification processes of metals can be analyzed. Analysis that considers super-cooling phenomena occurring in cast iron can also be performed.

▶ Shrinkage Cavity Analysis

By accounting for changes in the volume of molten metal during solidification, macro-shrinkage cavities occurring during solidification, as well as cavity shapes and sizes, can be predicted. Analysis for cast iron that considers super-cooling can also be performed.

Casting product

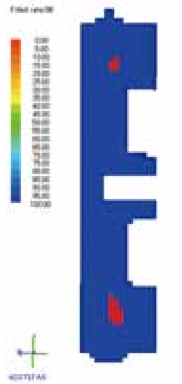


Shrinkage cavity analysis (shrinkage cavity prediction)

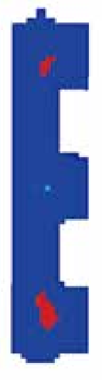
▶ Local Pressurization Analysis

Solidification analysis and shrinkage cavity analysis that consider the effects of pressurized pins on the supply of molten metal can be performed.
Analysis using tapered pin shapes is also possible.

Casting product



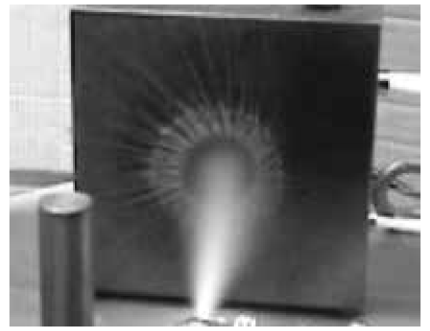
Shrinkage cavity volume with local pressurization (6.62cm³)



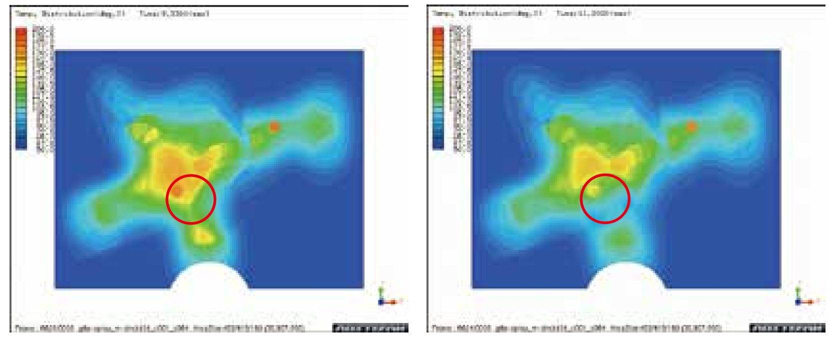
Shrinkage cavity volume without local pressurization (8.48cm³)

▶ Die Temperature Analysis

If processes such as shot processes, die opening, product removal, and blowing are provided as input, analysis of die temperature changes during repeated casting is performed. Die surface temperature changes due to parting agent spray functions, and internal die temperature changes due to water-cooled tube flow rate settings, can be analyzed. Furthermore, spot cooling can also be evaluated.



Status during spraying of parting agent



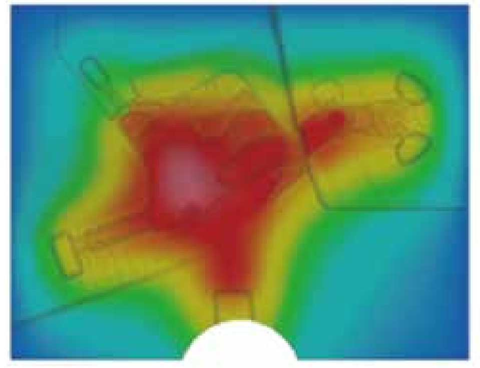
Use of parting agent spray functions
(area enclosed by red circle is spray jet location)

▶ Thermal Stress Analysis

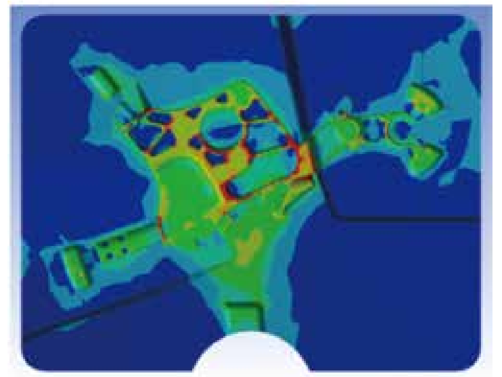
Analysis of the distribution and changes in stress occurring in castings and dies is performed without creating finite element meshes.

▶ Temperature Data Mapping

Temperature distribution data obtained through analysis with ADSTEFAN can be mapped onto finite element meshes. By setting the mapped data as the initial temperatures for thermal stress analysis or other procedures using commercial codes, detailed structural analysis can be performed.



Temperature distribution data obtained with ADSTEFAN



Stress distribution results after temperature mapping

▶ Independent Evaluation Variable Creation Tool

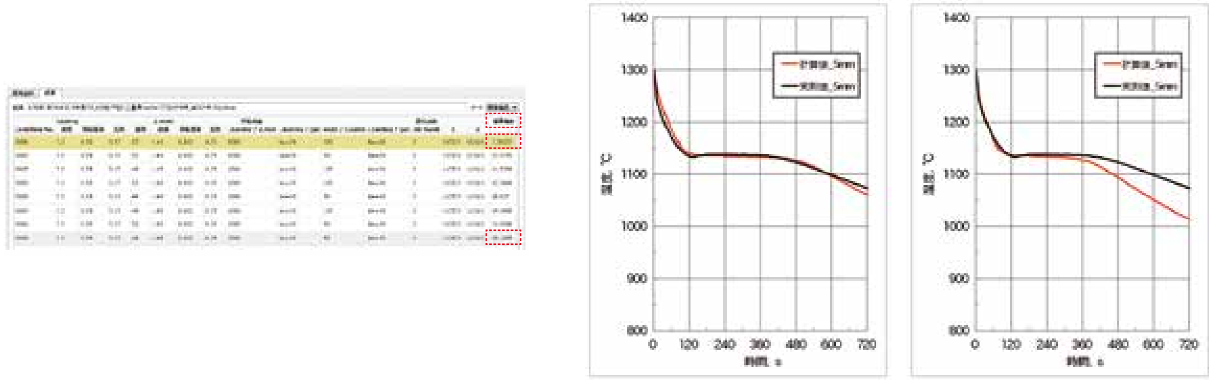
Function able to calculate desired solidification parameters and dendrite arm spacing (DAS) as independent evaluation variables, from the data results of solidification analysis.

▶ Arithmetic Operation Tool

Basic arithmetic operations can be performed on results obtained through analysis with ADSTEFAN, allowing users to establish their own independent evaluation indicators.

▶ >Material Property Value Calibration Tool

Solidification analysis with multiple material property value conditions can be executed automatically, and by comparing those analysis results with actual measurement data, optimal material property settings can be selected.



Display of results from material property value calibration tool