SHINRYO CORPORATION

The design engineers at this construction engineering company make the most of CFD analysis by effectively coordinating it with BIM (Building Information Modeling)

The demand for solutions to energy problems continues to grow, which underlines the significance of reducing energy consumption in the context of architecture lifecycle. SHINRYO CORPORATION has made remarkable achievements in the field of air-conditioning system design, which is crucial for solving this energy issue. They have introduced a way to incorporate CFD into their BIM system. This has equipped their engineers with the design tools needed to optimize air-conditioning systems.

SHINRYO CORPORATION
http://www.shinryo.com/en/index.html

Established	February 23, 1956
Location	Shinjuku-ku, Tokyo, Japan
Capital	3.5 billion JPY
Number of employees	1,948 (as of the end of September 2013)

Ken Fukada
Shinryo Corporation
Researcher of the CFD Solution Group
Research & Development Center
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Shinryo Corporation is a leading company in the design and installation of air-conditioning for building facilities. They have long provided district heating and cooling systems for entire cities, and the quality of their product is highly regarded. Shinryo Corporation's objective is to realize mutual sustainability for both human lives and the environment by implementing advances in environmental engineering technology.

Shinryo Corporation's three decades of experience using 3D-CAD is one of the enablers that has helped the company consistently produce low cost and high quality services. They developed their own BIM compliant software, S-CAD, based on Syspro's 3D-CAD software, DesignDraft, which is frequently used by architecture designers. S-CAD allows engineers to review models in 3D, simulate construction, run pipe interference checks, calculate static pressure and lifting height, and undertake quantity surveying. They are currently developing a 3D laser scanner that generates 3D models of existing facilities.

Mr. Ken Fukada from Shinryo Corporation, a researcher in the CFD Solution Group under the R & D Center, explains that the company started to apply S-CAD ten years ago. Mr. Fukada himself has been working with CFD applications since he joined the company. Shinryo Corporation has created education programs for S-CAD, which is now at the center of their operations; new staff members attend on-site training for their first six months where they learn how to use S-CAD and the basics of facility design. The company also offers continuous training opportunities for staff members to improve their engineering skills and knowledge.

Customizing CFD to Streamline Tasks

S-CAD was linked to Cradle's CFD analysis tool, scSTREAM, to perform fluid analysis of air-conditioning systems. Shinryo Corporation undertakes more than 150 CFD analyses a year with 70% of them being performed by design engineers. The engineers use the analysis for initial design and also for construction and promotion of their products. Mr. Fukada reveals that improving energy efficiency has been one of their clients' top concerns in recent years.

Shinryo Corporation reports that scSTREAM is useful fluid-thermal software, as they have been applying it for more than two decades across their nationwide locations, concurrently providing the ideal computing environment and hardware for their engineers to effectively perform analysis. Despite their successes, the company has realized two growing concerns; first, design engineers have been given more tasks to do, and second the accuracy of analysis results can be more dependent on engineers' skills and experience. To enhance efficiency and improve the quality of analysis, Shinryo Corporation revalidated their internal training program and also investigated ways to combine scSTREAM and S-CAD.

In 2008, they established their CFD Promotion Center to provide more support for analysis tasks, followed by installation of an HPC server in their R & D Center in 2010. This enabled their engineers to carry out analysis from different bases by acquiring licenses through the network. Mr. Fukada's division, the CFD Solution Group in the R & D Center, complements the efforts with

their work writing new software and developing expertise tackling more complicated analyses.

In pursuit of combining scSTREAM and S-CAD, the CFD Solution Group developed add-in software, S-Pre, which facilitates the transfer of data between S-CAD and scSTREAM. When working with design data for building facilities, S-Pre transfers only the data necessary for the CFD analysis from S-CAD to scSTREAM via Cradle's VBI. Engineers can specify CFD settings easily using the customized tool box in the S-CAD window.

The development of S-Pre started five years ago, when Mr. Fukada joined the company. Engineers had provided feedback that importing 3D-CAD data directly to scSTREAM would provide significant value. This led to the development of the add-in function to enable the model transfer. Previously, engineers had to re-model each time they conducted an analysis using scSTREAM. This created much additional work because the engineers had to extract all the design information from the original drawings. When the analysis and design functions were performed by different engineers, communication errors frequently occurred. In contrast, by using S-Pre, all engineers can directly use the data from S-CAD and avoid communication related errors. Even those who are unfamiliar with operating scSTREAM can set up analysis conditions from S-CAD.

Five Optimizing Functions for Effective CFD Analysis

The primary function of S-Pre is to transfer necessary data between S-CAD and scSTREAM. Since not every analysis requires all the CAD data, S-Pre can selectively transfer only data for the area needed for analysis; for example, it can even pinpoint and select certain furniture in a room.

A second function serves as a part manager that can track and organize the design information for each part, such as building structure, piping and duct. Designs are produced by a number of engineers simultaneously working on each section, and are later merged together. Previously the engineers had to re-create models for scSTREAM and extract the design information. However, with S-Pre only the necessary design parts can be easily copied to generate a new design for the CFD analysis.

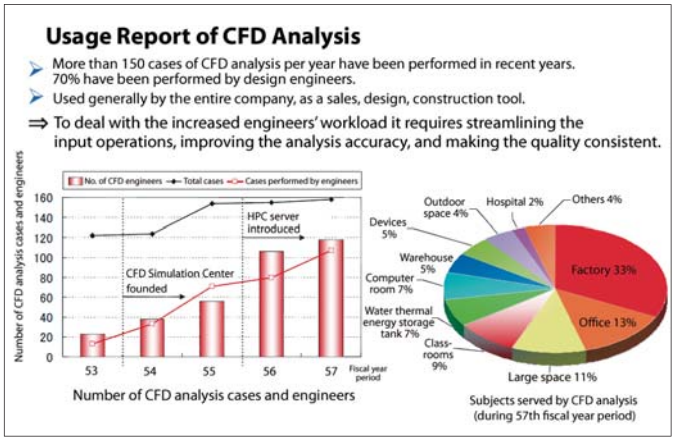
The third function is the specialized interface for CFD analysis of the building facilities. The interface was customized to present only the analysis conditions required for designing building facilities, which enhanced the operability. In other BIM software, engineers can only specify a limited number of input conditions, such as material properties and the amount of heat generated near the air supply. With S-Pre, engineers can include more information, such as wind velocity, temperature, heat transfer coefficients, heat generation, and drag coefficients. The setting window for these conditions can be viewed by selecting each component in CAD, without activating CFD analysis software.

The fourth function is a conversion function to simplify models. One example where this function is useful is for the air exhaust, a model that is difficult to represent precisely. Simplification of its geometry and the surrounding objects enhances the calculation stability and minimizes the number of mesh elements required.

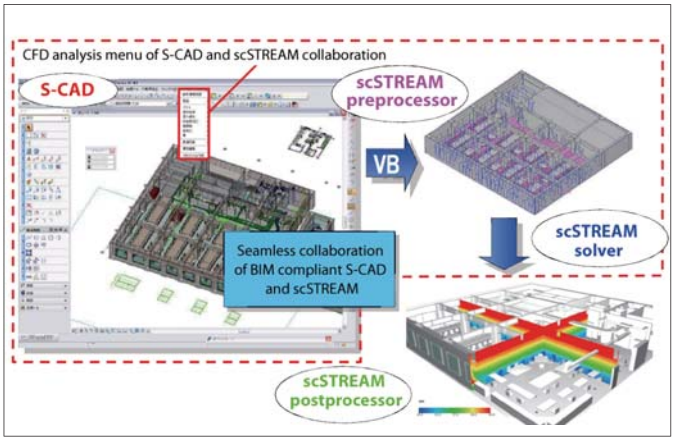
The fifth function is automatic mesh generation, which enables all engineers to generate high quality, stable meshes. Shinryo Corporation is continuously improving this function to produce high quality meshes while maintaining sufficient mesh resolution.

Encouraging All Engineers to Explore New Ideas

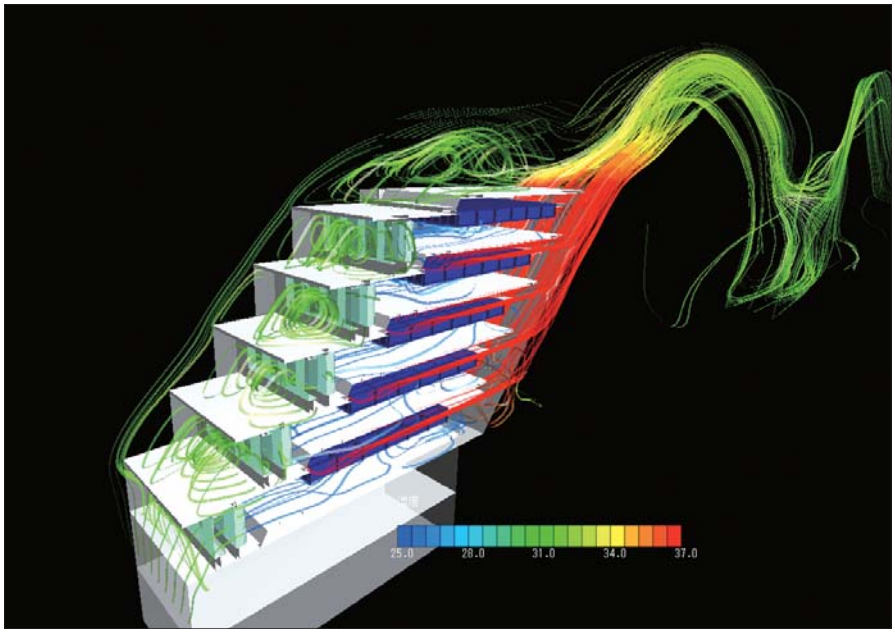
Mr. Fukada explains that Shinryo Corporation has dramatically reduced the time needed to review models by combining scSTREAM and BIM. Evaluating large-scale structure often



Shinryo Corporation's CFD Analysis Task Structure



Seamless collaboration of BIM compliant S-CAD and scSTREAM



Example of CFD analysis results: Air-flow analysis of a server room (Build Live Kobe 2011)

takes a long time but with S-CAD's ability to transfer 3D model data directly to analysis, the analysis time can be reduced by up to 50%. Another benefit of using scSTREAM is that design engineers, including younger staff members with less experience, are encouraged to analyze the air-conditioning performance and actively suggest better ideas. "If engineers know they can test with analysis, it encourages them to evaluate more ideas. Being able to review visual results generated by scSTREAM is also helpful for deepening their understandings," says Mr. Fukada. By using scSTREAM, engineers can start to recognize trends and patterns from the analysis, which were only previously possible to be identified at the construction site. The software also enables senior engineers to check calculation conditions and results and train younger engineers to perform the analysis. Lastly, the engineers in the CFD Solution Group used to add new functions through user-defined programs before the upgraded version of scSTREAM became available. Now new functions can be added more simply through the preprocessor which enables engineers to design and use more complicated air-conditioning analysis conditions.

Easier and More Accurate CFD Analysis

Although Shinryo Corporation has fully implemented CFD analysis into their design process, they are eager to improve the engineers' analysis abilities. The company also wants to ensure they make the best computing hardware available for better analysis. Their engineers can face problems with overly complicated meshes when using the raw CAD data model for CFD analysis. To solve this, Shinryo Corporation is planning to introduce modeling guidelines and/or develop algorithms to convert CAD data into CFD analysis model.

They are also planning to construct a library of air properties in collaboration with the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan. This will enable their engineers to effectively perform analysis and share the acquired knowledge with others.

Until recently, Shinryo Corporation has focused on improving the input data for analysis. In the future they also want to improve the output by enabling their engineers to view analysis results using S-CAD. Currently the output results can only be viewed in scSTREAM. Mr. Fukada estimates this will be a challenge as it involves collaboration with S-CAD. But he is convinced that once the engineers can directly view output results in S-CAD, it will be easier for them to switch the air-conditioner from summer to winter mode, and scan the entire tasks on S-CAD.

Mr. Fukada is keen on ensuring the accuracy of the analysis results. This will require enhancement of the company's engineers' individual skills. Shinryo Corporation currently provides one-on-one analysis training, but they are concerned about maintaining high quality training when they have more engineers. Mr. Fukada says this will have to be given more attention in the future.

For now, CFD analysis is mainly performed by engineers, but in-house feedback suggests that the construction staffs may want to develop analysis skills since designs can be altered on site. This capability could be realized if there is sufficient network bandwidth that enables rapid download of the analysis results, says Mr. Fukada.

Shinryo Corporation has made great progress implementing IT analysis tools into their design process, and they continue to explore new applications. In today's industry where reducing building energy consumption is a key issue, they have made great contributions by using scSTREAM to help them design more efficient air-conditioners.

Featured Software

scSTREAM

scSTREAM uses a structured mesh to model general purpose thermal/fluid applications where tiny details and curved surfaces are not critical for an accurate simulation. scSTREAM can both create the mesh and calculate the solution quickly and efficiently using the finite volume method. A ten million element model only consumes 5.5GB of RAM. In addition to highly capable models for simulating complex physics, scSTREAM also includes a set of Visual Basic interfaces and table/function inputs that make it customizable.

Cradle
MSC Software Company

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www.cradle-cfd.com/inquiry/index.html