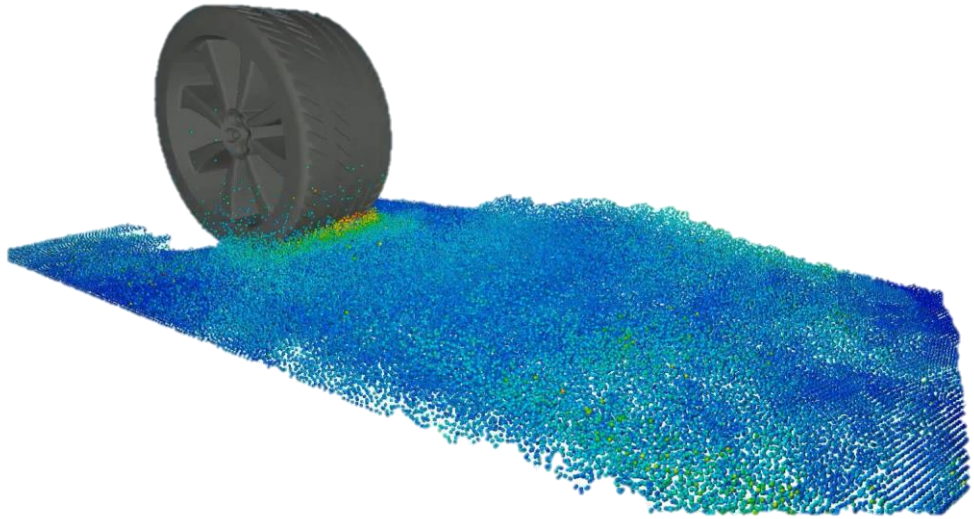
E8IGHT

NFLOW

3D Fluid Simulation S/W, **NFLOW**

NFLOW is a CFD Total Solution Platform based on the meshless method including SPH, LBM. It can be used in all fields of fluid analysis including gas and liquid, and provides the service that customer wants all process from design to verification. Compared to previous CFD software that requires mesh for analysis, anyone can use it quickly and easily since there is no process for pre-processing. And users can more accurately and reliably analyze the movement of fluid without even creating a separate grid. There are NFLOW SPH and NFLOW LBM programs which are specialized in analyzing the physical properties of fluids.



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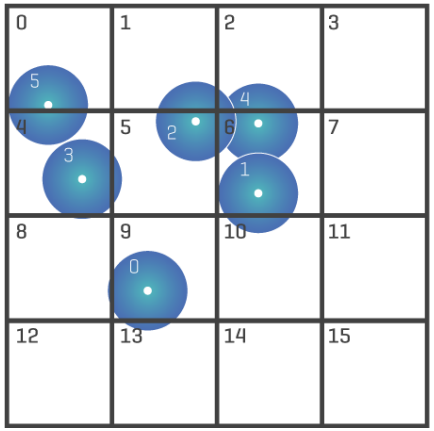
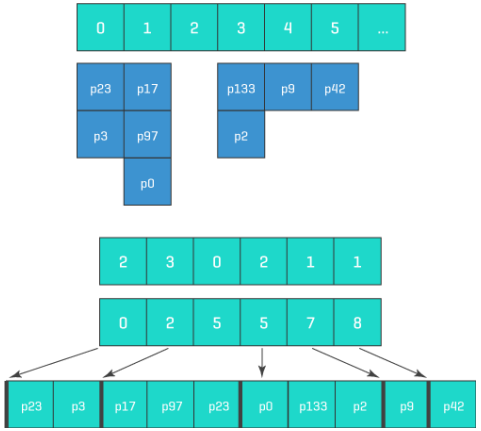
BEST
Particle–based Processing algorithm

Particle based processing algorithm

NFLOW has its own algorithm that finds neighboring particles quickly by making a search data structure according to the position of each particle:

- Splitting the entire analytical area.
- Searching for particles belonging to a divided space.
- Searching the surrounding space and search for particles belonging to the reference particle.





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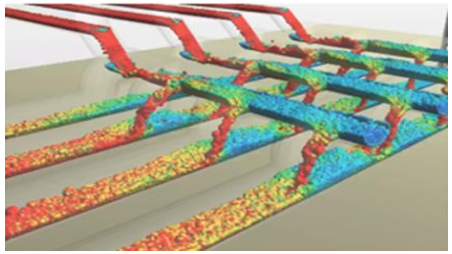
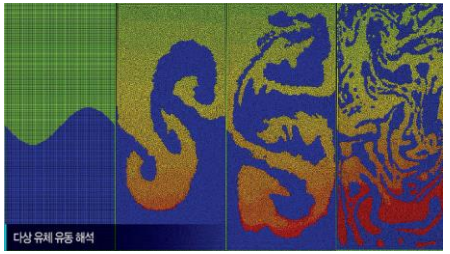
MULTI
Multi–Phase
Flow Analysis

Multi–Phase FLOW



Oil, Gas and Bubble in a slug catcher
Analysis of multi–phase flow such as gas, oil and bubble from deep ocean in a slug catcher.

Oil in twin screw pumps
Analysis of the flow characteristics of Oil and Gas Mixed in different direction of twin screw pumps.



Multi–Phase Flow Analysis
NFLOW can analyze Multi–Phase flows in which two or more fluids with different physical properties mixed(Gas, Oil, or Liquid).

What is Multi–phase Flow?

NFLOW can analyze Multi–Phase flows in which two or more fluids with different physical properties mixed(Gas, Oil, or Liquid). It can be applied in many industries such as petroleum/ chemical/ pharmaceutical. Understanding the Physical Characteristics of Multi–Phase plays a key role in optimizing the production and design process of the product.

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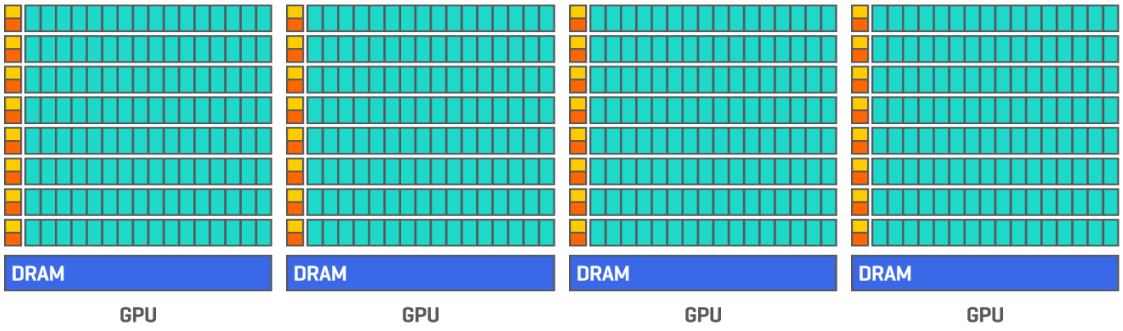
FAST
GPGPU
Parallel
processing
technology

Multi GPU Algorithm for Analysis Speed improvement

Multi GPU Algorithm

Multi GPU is the technology using a multi-professional graphics processing unit (GPU) to intelligently improve the performance of applications and significantly increase the velocity of workflow, which provides overwhelming velocity compared to traditional CPU software.

- Parallel processing technology (GPGPU) applied to perform 8 times faster than CPU
- Performance Solver combined with high-speed computing GPU parallel operation processing code
- Multi GPU load balancing technology for even distribution and distributed processing



〈Multi GPU Algorithm〉

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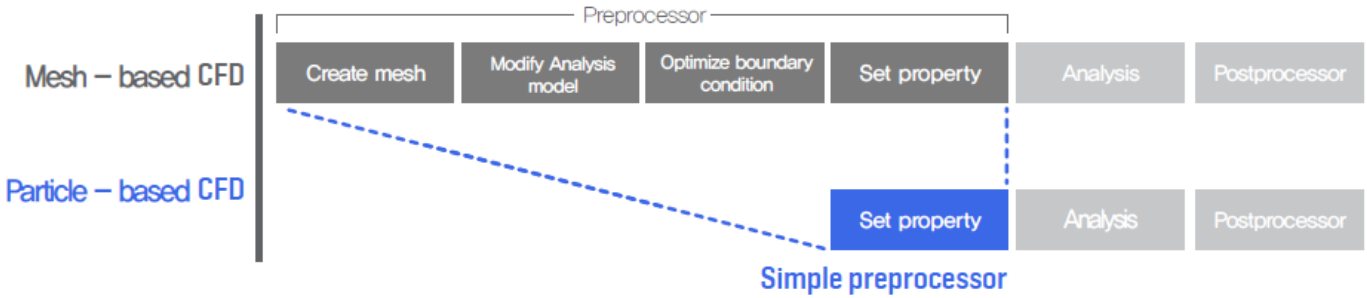
SIMPLE

Simplify the preprocessing with Meshless

Pre-processing process Elimination for driving the Efficiency

- Elimination of inefficient manual time for mesh generation minimizes analysis time and increases work efficiency
- By setting attributes, nonprofessionals can easily prepare for analysis



〈Pre-processing process Elimination〉

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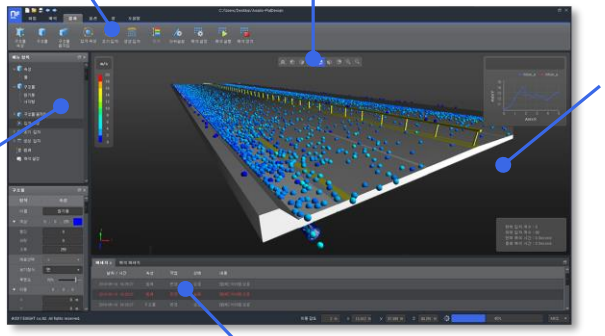
EASY
Intuitive and convenient working environment

Intuitive and Convenient Working Environment

- Provides an integrated work environment that allows user to work with one window.
- It is possible to print 3D simulation results in various formats such as charts and videos.

Intuitive and Convenient interface
One-window Comprehensive Work Environment
Output in various formats (Chart and Video Functions)

View Control in any direction
The user can move the desired point of view by using a mouse, keyboard and quick-view icon



Analysis report generation
Generation of the format of automatic report user want

User-friendly Functions
Support Various style, Theme and Multilingual functions

Real time(RT) Verification
View details of the current work process in the attribute window, message window etc

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NFLOW SPH

NFLOW SPH is the first fluid simulation software developed by applying particle method (SPH method). It can be used in all fields requiring fluid flow analysis such as multi-phase, interaction with rigid body, free surface analysis, particle visualization.

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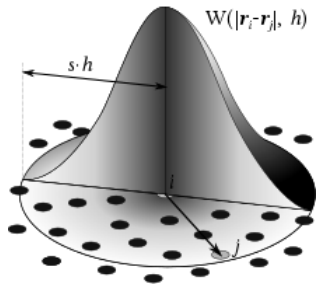
NFLOW SPH Overview

SPH History

SPH [Smoothed Particle Hydrodynamics]

SPH is a meshless Lagrangian Method developed by Monaghan to calculate astrophysical phenomena problems with Particle Method. In the 1990s, it has been used extensively in the engineering field. Compared to traditional numerical methods, there have been active researches on SPH in academia and industry for the past 20 years, and it has been applied to highly ductile materials, fluid–solid interactions, compressive and incompressible fluid flow analysis.

Why SPH?



Unlike the finite element method (FEM) and the finite difference method (FDM), which are numerical methods of Eulerian method based on the mesh, SPH is one of the meshless methods and it analyzes the flow by following the motion of the fluid material point, This unique nature makes it easier and more flexible to interpret physical phenomena that are difficult to interpret based on existing mesh. In particular, nonlinear free surface flow can be analyzed excellently, making it easy to interpret complex and dynamic flow phenomena such as tire aqua planning, gearbox oiling, and spraying, and it provides good results for free surface phenomena such as droplets, droplets, and bubbles caused by static conditions or interaction with moving objects.

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NFLOW SPH Overview

What is NFLOW SPH?

NFLOW SPH, 3D CFD Software

NFLOW SPH analyzes various flow problems encountered in various industries using particles utilizing SPH as a tool for analyzing particles. Based on the characteristics of SPH, we have developed an optimized algorithm that not only improves stability as an analysis program, but also provides an intuitive and easy-to-use UI for users to use easily.

Need for NFLOW SPH

1) Analysis of complex flows such as multiphase flows

In the case of FDM or FVM using a grid, it is difficult to search for a boundary that requires high accuracy because numerical instability of the termination part occurs when expressing the boundary surface of each phase. On the other hand, NFLOW SPH using SPH method has flexibility in dealing with large changes of interface such as free surface because each uses particles having inherent physical quantity.

2) Applied in various fields

Existing mesh type analysis tools are analyzed in limited spaces and structures, while NFLOW SPH is analyzed based on particle characteristics, so there is no limit to the size of the object to be analyzed. It can be used in various fields depending on the size of structure and space, and it is highly usable for analysis according to users.

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NFLOW SPH

NFLOW SPH Applications

Marine & Engineering

Efficient and economical design of BWMS

The ship's ballast water treatment system (BWMS) in large vessels is a water treatment system required to protect the marine ecosystem. Although the installation of bwms is mandatory, there are still many cases where a conventional ship is not equipped with BWMS or is out of specification. Also, validating the designs by creating physical models with the burden of design costs ranging from at least billions to tens of billions. However, this process is costly and time consuming. On the other hand, NFLOW SPH not only improves the efficiency of design by showing the adequacy of piping size and bending by grasping the flow pressure and velocity in the piping during the design verification process, but also uses simulation to replace prototype manufacturing with excessive cost consumption and unnecessary time consumption can be reduced.

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NFLOW SPH

NFLOW SPH Case Studies

Marine & Engineering

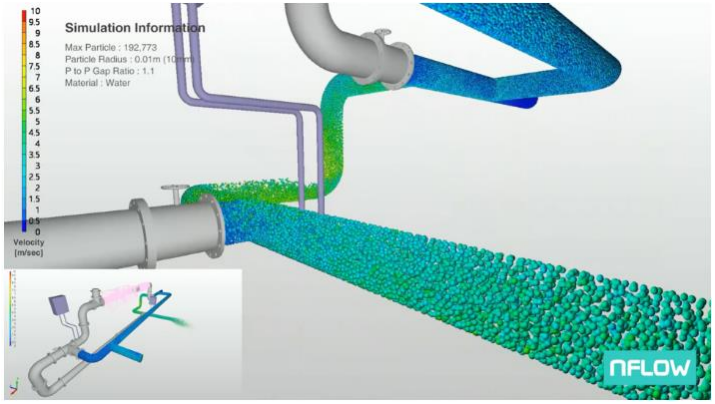
Simulation results of fluid flow in BWMS using NFLOW SPH

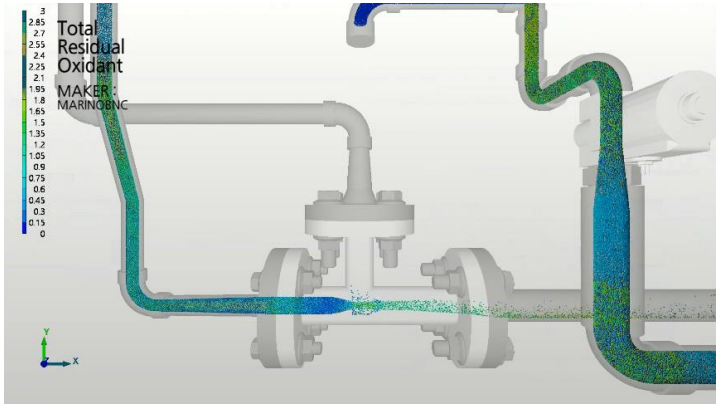
NFLOW SPH can be used to check the flow of seawater in a ballast pump. We measured the average pressure and velocity inside the piping to predict the incompressible and compressible fluid flow and checked whether there was a problem in the design and suggested the optimal design.

Marino B & C (KT Marine),

Confirmation of fluid flow in BWMS

- Check ejector fluid flow
- Check the hydraulic pressure in each piping section.





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NFLOW SPH

NFLOW SPH Applications

Civil Engineering

Review of road drainage vulnerability section and design optimization proposal

There are steadily growing cases of flood damage to roads and surrounding areas. So, the drain is usually redesigned to prepare for this. However, designs that rely on existing 1, 2–dimensional design guidelines are difficult to identify by eye and often have difficulty in proper design and rebound. NFLOW SPH can simulate the drainage and drainage flow of the existing drainage facilities through 3D simulation and present the proper specification of the drainage structure in case of flooding situation.

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NFLOW SPH Case Studies

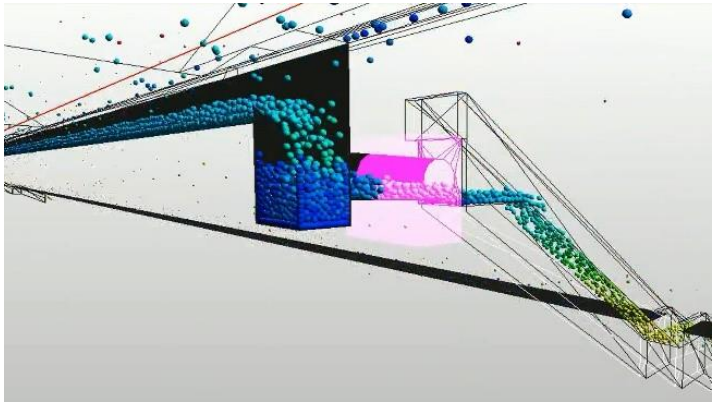
Civil Engineering

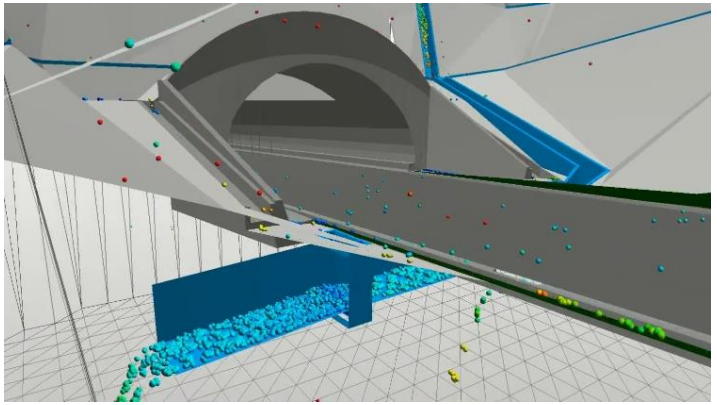
Proposal of road surface drainage and structure design using NFLOW SPH

We use NFLOW SPH to verify the status of drainage facilities at the design stage and to prevent errors beforehand, and to propose optimized design by immediately checking for problems with existing facilities.

Korea Highway Corporation, Review of drainage capacity of Saemangeum – Jeonju highway

- Check drainage capacity
- Identify bad segments
- Check drainage and flow rate





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NFLOW SPH

NFLOW SPH Applications

Dams, River, Catastrophic Events

Review the propriety of water facilities

Large floods of dams and rivers caused by heavy rains can lead to loss of social overhead capital, damage to property of individuals and loss of lives. Simulation of water facilities such as dams, reservoirs and rivers is now essential to prevent enormous damage. NFLOW SPH assists you in verifying water facilities, assessing the risk of facilities, and preparing mid– and long–term planning and management measures for various situations.

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NFLOW SPH Case Studies

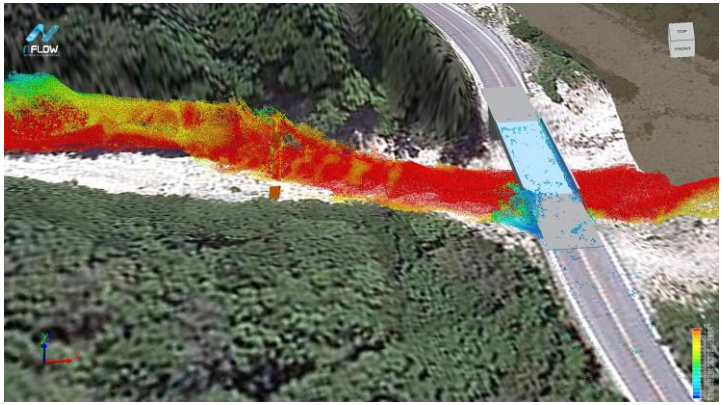
Dams, River, Catastrophic Events

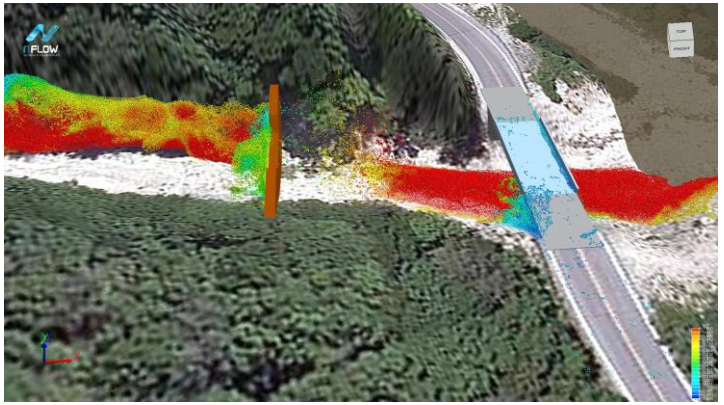
Verification and prediction of dam, river, disaster situation using NFLOW SPH

Using NFLOW SPH, you can check various information such as flow rate, water rate and water demand of water facilities in real time. In addition, you can assess the risk of water facilities for extreme weather events such as heavy rains and simulate dangerous areas caused by dams and reservoir collapses to prevent disasters.

Confirmation of Direction of Excellent Direction Simulation before and after installation

- Check the storm water and debris flow from valleys
- Suggested the installation of debris barrier





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NFLOW SPH

NFLOW SPH Applications

Manufacturing

Review the propriety of Mechanical Design

Global competition is accelerating, and companies face the challenge of reducing development costs, shortening development time, and improving quality to deliver better products and services. Engineers strive to find the optimal design figures and to give customers confidence. NFLOW SPH offers a way to optimize design to solve the repetitive and chronic problems of these engineers at design time.

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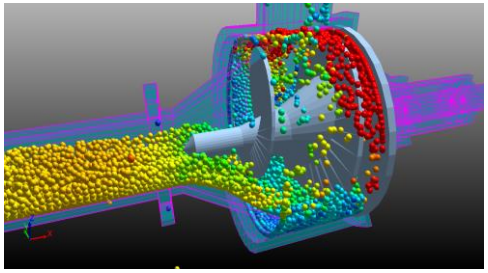
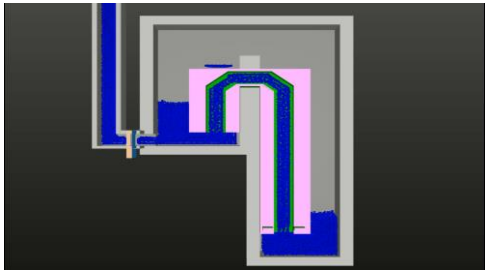
NFLOW SPH Case Studies

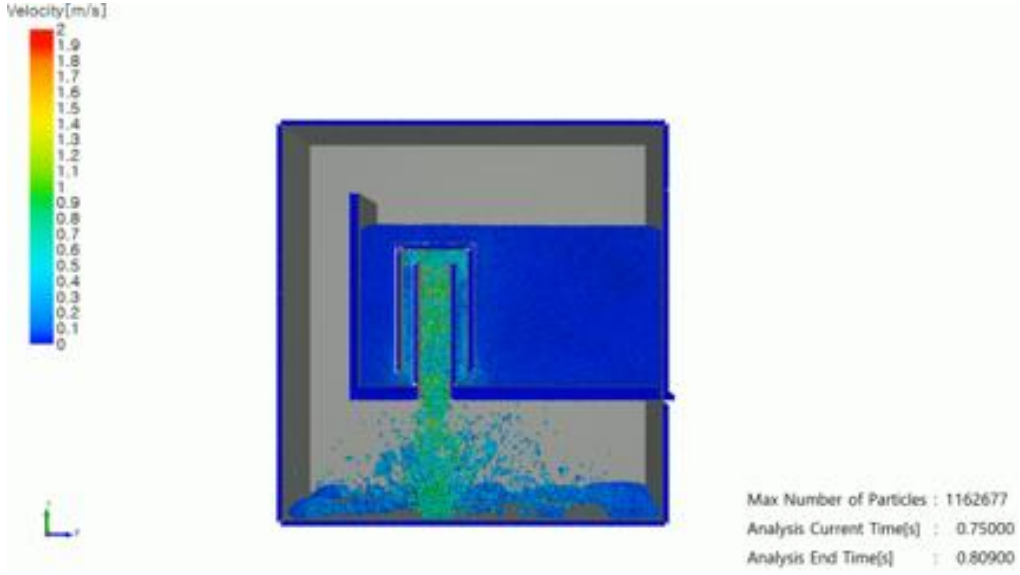
Manufacturing

NFLOW SPH for optimized design

Using NFLOW SPH to help you design products in the machine and manufacturing industries. Simulation allows you to create desired design models by adjusting parameter values such as flow, pressure, and speed of fluid flowing inside the structure to be designed. In addition, considering the flow of compressible, incompressible fluid flow, you can compare the size of the machine inner tube and identify the most efficient tube size and shape.







Fluid flow simulation in valve / Siphon simulation

- Mixed fluid flow analysis
- Comparison of fluid flow by Tube Size

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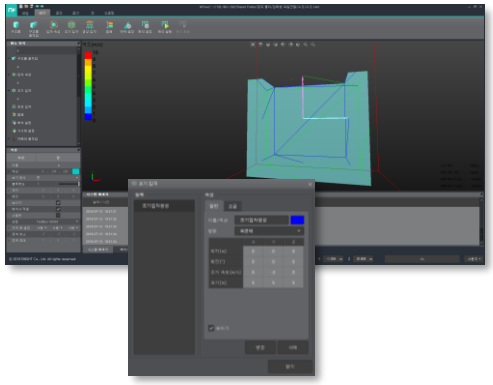
NFLOW SPH

NFLOW SPH Workflow

Pre-processing, Solver and Post-Processing

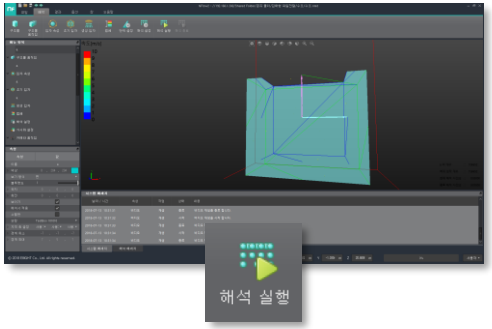
NFLOW SPH can be easily used in one GUI for pre-processing, solver and post-processing, and offers a variety of additional functions.

Pre-processing



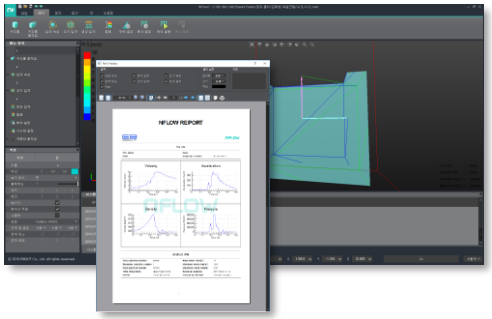
- Structure and Structural Movement Setup
- Set particle properties (initial particles, generated particles)
- Analysis settings

Solver



- Perform analysis

Post-processing



- Analysis result report (legend, chart, measurement)
- Moving Camera (camera movement setting possible)

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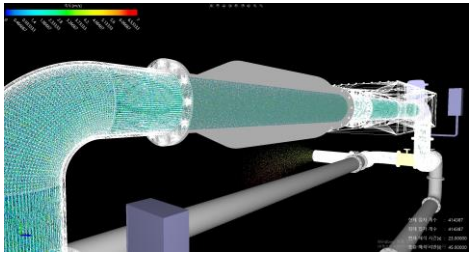
NFLOW SPH

NFLOW SPH Workflow

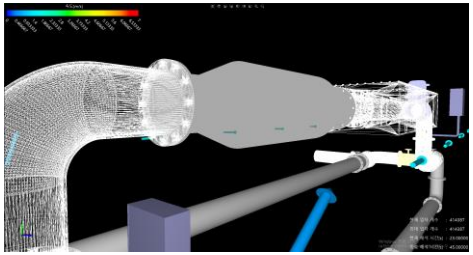
NFLOW SPH Post processing – Visualization

NFLOW SPH includes a post-processing feature that allows you to visualize your analysis results in multiple ways with powerful rendering capabilities.



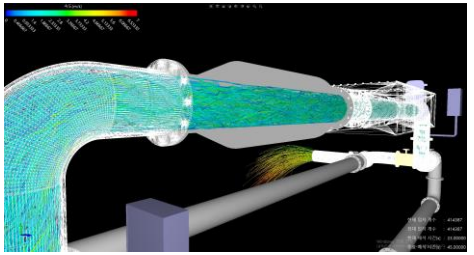
Particle (sphere) Visualization

The properties of the fluid (velocity, acceleration, density and pressure) can be expressed in color by representing the particles in a sphere at the location of the fluid.



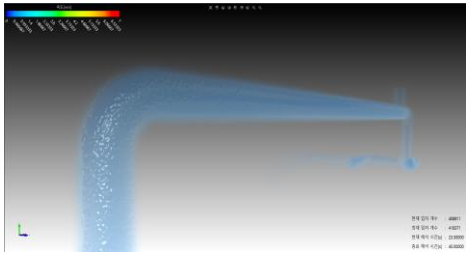
Vector Visualization

The analysis space is divided into grids and the average of the properties (velocity, acceleration, density and pressure) of the fluids contained in the grid are expressed.



Trajectory Visualization

It is a method of expressing the flow of fluid by connecting the position of each frame of fluid used for analysis in pipe (or line) and expressing the properties (velocity, acceleration, density and pressure) of fluid in color.



Water effect Visualization

A method of expressing water-like effects by using the position of a fluid.

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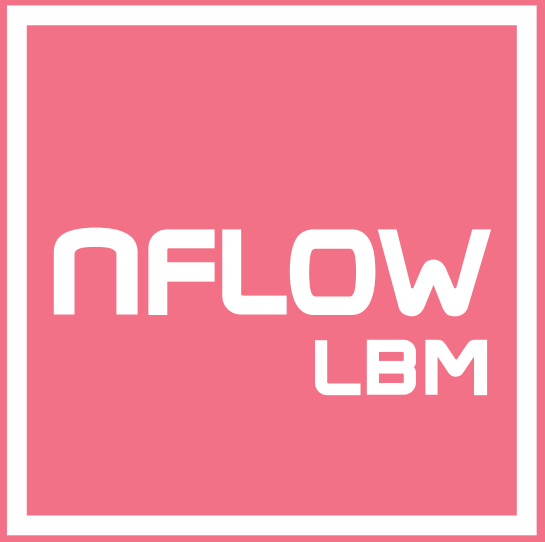

NFLOW LBM is a software developed by combining LBM (Lattice Boltzmann Method, a method of calculating the probability distribution of particle velocities) with the existing NFLOW and has excellent advantages in gas and thermal analysis.

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nFLOW LBM

Lattice-Boltzman vs. Navier-Stokes

Navier-Stokes Equation	Lattice-Boltzmann Equation
Macroscopic equation	Mesoscopic molecular distribution equation
Need to treat nonlinear convection term	Treat linear convection term only
Integral or differential form of equation	Discretized equation
Solving the equation using iteration method	Solving the equation using explicit method
Capable of steady and unsteady state analysis separately	Adequate for unsteady state analysis
Need to solve the Poisson equation to get the pressure	Obtaining the pressure through an equation of state

NFLOW LBM

NFLOW LBM Applications

Automotive

Automotive design became important for aerodynamic design and temperature control system. Because electric cars and luxury car market are increase due to interest in equipment for fuel–efficient vehicles, NFLOW LBM is a CFD software for aerodynamics and thermal simulation in automotive industry.

Solutions for Automotive Application

- Aerodynamic for wheels, suspensions, etc.
- Analysis of heat flow
- Air conditioning system
- Lubrication system for powertrain

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NFLOW LBM

NFLOW LBM Applications

Aerospace

The demand for simulation is also increasing due to the needs of R & D in aerospace industry. Aircraft manufacturing companies used CFD for wind tunnel testing and flight testing to check the performance of designed products. It is also used to design external aerodynamics, fuel systems, engine core compartments,
missiles, cockpit and cabin ventilation, and submarines.

Solutions for Aerospace Application

- Analysis of air flow around the wing
- Analysis of heat flow
- fan and wing efficiency
- Exhaust system

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NFLOW LBM

NFLOW LBM Applications

Electronics

The electrical and electronics industry is growing at a fast pace because of the growing demand for semiconductor components, consumer durables, electronics goods, and high–technology products, especially in China, South Korea, India, and Japan. The countries in APAC that played a significant role in the cloud CFD market include China, Japan, and Taiwan. Smartphones were the major areas of R&D in the electrical and electronics industry.

Solutions for Electronic Application

- Freezing cycle simulation
- Analysis of Heat Transfer
- Analysis of heat flow for product
- Rotor dynamic analysis

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NFLOW LBM

NFLOW LBM Applications

Energy

Competition in the energy market is intensifying. Because of this, companies are using CFD for efficient their work processes. NFLOW LBM provides simulation results in various fields from heating furnace, nuclear reactor, blast furnace power generation to hydropower, nuclear power, and renewable energy generation, so that design cost and time can be saved, and problems can be predicted in advance for quick response.

Solutions for Energy Application

- Wind Turbine Simulation
- Heat load simulation
- Oil and gas flow analysis

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nFLOW

Customer Service

Close contact to our customers and qualified service are what characterize us.
Here you can find out how to contact us, get information, and which support and services we offer.

CFD Solutions

- Pre–Project
- Trial Case

Free Demo program

- Free Demo programs

Manuals and materials

- User’ s manuals
- Tutorials

Seminars

- Regular seminars
- Visiting training
- Customized training

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Product and Purchasing Inquiries

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