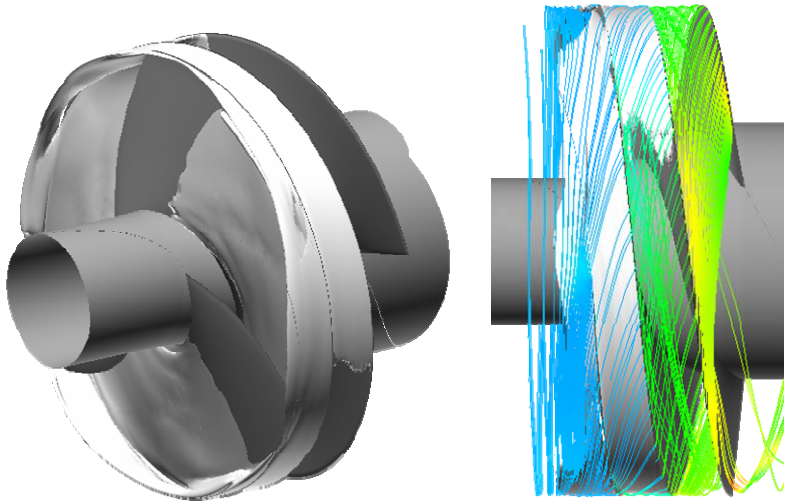
R&D field: Engineering

# Computation of Unsteady Cavitation Flow by the Finite Difference Method

- Program name：Cavitation
- Developer
  - Yoichiro Matsumoto, Prof. of The Univ. of Tokyo
  - Kohei Okita, Researcher of RIKEN
- Abstract
  - Cavitation is the phenomena that microbubble nuclei in a liquid rapidly expand, shrink, and collapse with phase change, which results in extremely complex flow field of mixture of fluid and gas. This Cavitation program describes the phenomena based on a set of fundamental equations including the cavitation and turbulence models.
- Algorithm
  - Time integration based on the fractional step method for incompressible flow.
  - Fortran.
  - Parallelization with shared and distributed memory based on domain decomposition.
- Current computation size
  - Memory 12GB and disk 2TB (3 million lattice points).
  - Sustained performance 60 GFLOPS（NEC SX-6 24CPUs）.
- Future computation size in 2010
  - 1000 times of lattice points and 10 times of time resolution, totally 10 thousand times of the current calculation amount.
  - Memory 12 TB and disk 2 PB.



Cavitation flow around an inducer

Cooperation by IHI

- Expected results
  - In fluid-machinery and piping systems, cavitation may cause instability phenomenon and material damage to the systems.
  - Although we are not yet ready to estimate material damage caused by collapse of cavitation bubbles, we will be able to simulate it precisely based on high-resolution computation taking care of mesoscale bubble behavior and interference with turbulent vortices.
- Reference
  - http://www.fel.t.u-tokyo.ac.jp