

# Improving Fan Efficiency with CFD Application

Case Study for Panasonic Ecology Systems Co., Ltd.

Verifying static pressure efficiency and fan characteristics by using SC/Tetra

## Utilization of CFD Software in Fan Design

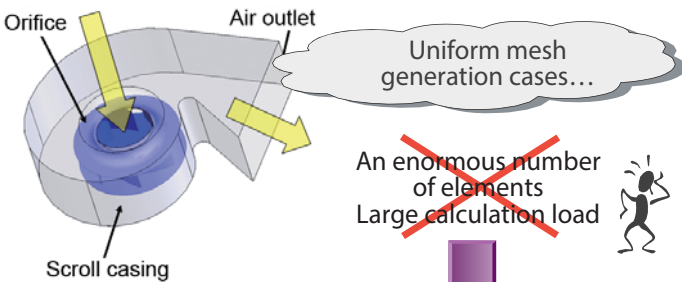
CFD software can be a highly effective tool to improve fan efficiency. In CFD simulations, engineers can see the generation of vortices by visualizing the flow field around fan blades, and estimate the efficiency of the fan from the calculation results on static pressure and torque.

### Simulation model

**Key point:** To create a fan model with enough accuracy required for performance evaluation within a practical range of computational load.

### 1. With a scroll casing:

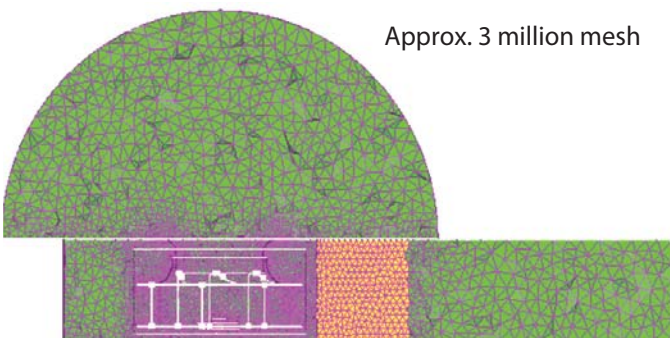
A non-axisymmetric model. The entire perimeter of impellers is required for its analysis range transient analysis because performance of the fan is significantly influenced by geometry of the scroll casing and by positions of the blades.



Heavily affected regions  
Less affected regions

Fine mesh  
Coarse mesh

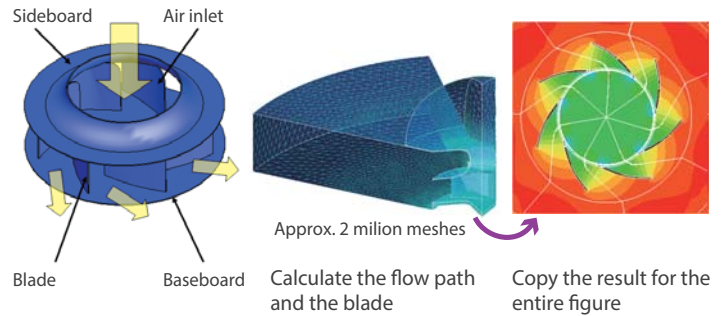
Approx. 3 million mesh



Decrease computation time & maintain accuracy

### 2. Without a scroll casing:

A flow path between each axisymmetric blade is assumed to be same, and the flow circulation is periodically repeated.



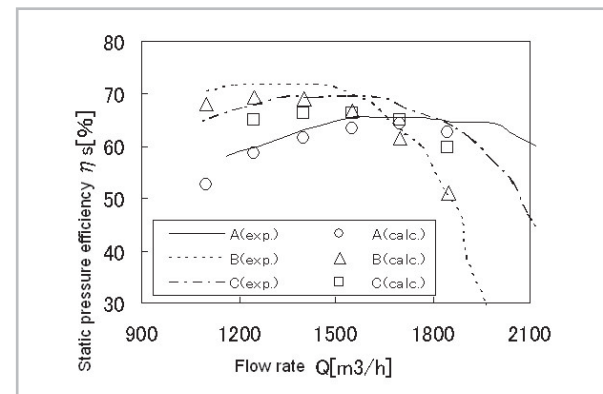
### Comparison of results

[Without a casing]

Three types of centrifugal fans with different dimensions are compared.

|                      | Model (A) | Model (B) | Model (C) |
|----------------------|-----------|-----------|-----------|
| Fan diameter         | 229 mm    | 229 mm    | 229 mm    |
| Blade inner diameter | 142 mm    | 156 mm    | 156 mm    |
| Blade thickness      | 62 mm     | 62 mm     | 82 mm     |
| Orifice height       | 29.5 mm   | 39.5 mm   | 39.5 mm   |

Approx. 2 million mesh, k-eps model



Maximum Static Pressure Efficiency (B) > (C) > (A)

Air Capacity at Best Efficiency Point (A) > (C) > (B)

**Showing simulation curves consistent with experiment**

The consistency is also confirmed for the casing types

### Customer Comments

A suitable CFD simulation model of the fan is used to identify effective parameters for improving fan's efficiency. Reduction in power consumption of fan has always been one of major challenges.

While high performance computing is growing fast, developers of high-efficiency fans count on CFD applications for complicated analyses.