CFD Application for Fan Performance Improvement

Case Study - Teral Inc. and Teral Kurita Inc.

SC/Tetra for more efficient fan product development

## Turbofan

TERAL

▶ Used for:

Drying machine

Dust collector

Separator

To reduce environmental burden, the company has been developing more energy efficient fans with less noise and lower vibration. They used CFD analysis and other simulation tools, such as structural analysis software, during fan development to assess and evaluate product capability.

Analysis Objective and Model

The analysis investigated fan performance and identified the optimal fan models by visualizing the fan's inner flow and pressure distribution and evaluating velocity, pressure and efficiency.

Vane wheel
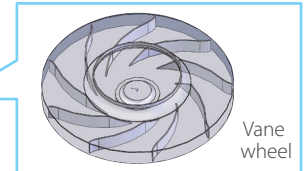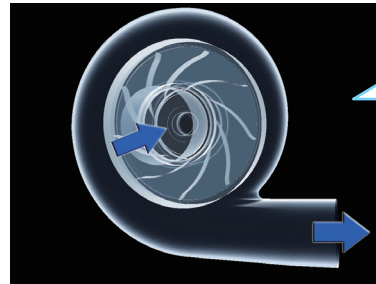
Number of Mesh Elements:
Approx. 7.8 million mesh elements
Analysis Condition:
- Steady-state analysis
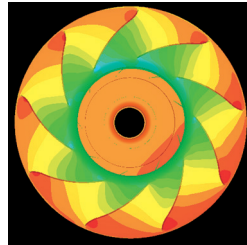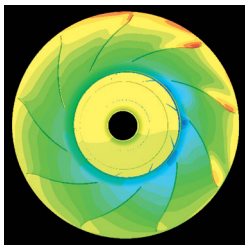- ALE (rotating boundary), rotating/stationary regions

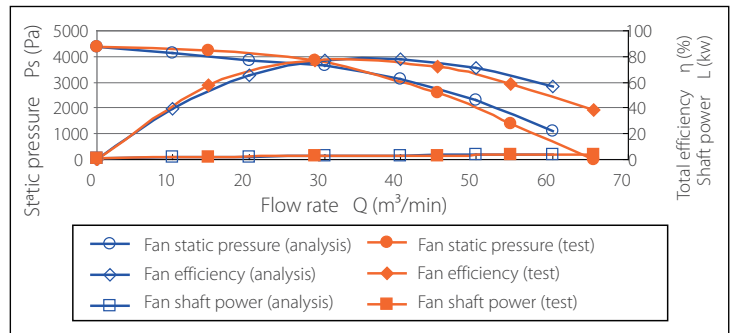## Comparison Between Analysis and Test Results
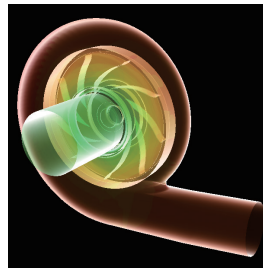
*power source frequency is 60 Hz

🔍 Visualizing pressure distribution

Comparison between flow rate of 10 m³/min and 40 m³/min

10 m³/min air-flow
39.2% total efficiency

40 m³/min air-flow
78.2% total efficiency

		Analysis Results for Fan Total Efficiency							Test Results	
		1	2	3	4	5	6	7		3	4
Air flow	Q (m³/min)	0	10	20	30	40	50	60		29	45
Total pressure	P_t (Pa)	4393	4158	3981	3965	3680	3143	2306		4064	3159
Static pressure	P_S (Pa)	4393	4125	3848	3669	3141	2312	1126		3825	2580
Shaft power	L_0 (kW)	1.27	1.77	2.02	2.56	3.14	3.69	4.09		2.54	3.26
Total efficiency	η (%)	0.0	39.2	65.6	77.3	78.2	71.0	56.4		76.8	72.4

As indicated in the graph above, the analysis and experimental results have excellent correlation.

Customer Comments

Applying SC/Tetra enabled us to evaluate fan performance and study optimal modeling at the same time. It also helped us to examine performance at various stages in the design and development phases by visualizing the movement of a vane wheel, inner flow within the fan casing, and pressure distribution. We achieved 86.5% total efficiency (at 50Hz) by applying a newly designed vane wheel, demonstrating the significant role SC/Tetra played in the design of the optimal fan that keeps noise at a minimum. Overall, we have successfully reduced the number of prototypes and production tests by applying fluid analysis. This has contributed to reducing cost and development time.