



# Cradle CFD Innovation that Achieves Excellent Indoor Air Circulation

By **Mr. Masahiro Shigemori, Panasonic**

**P**anasonic Ecology Systems (hereafter the Company) has been tackling Indoor Air Quality (IAQ) improvement for many years. As well as dealing with ventilation and dehumidification, the Company has pursued achieving quality living environments through providing pleasant air flow and smell. Their market leading product range includes ventilation fans, kitchen hoods, air cleaners, and roof fans, and is also available in many countries in Southeast Asia. To design and develop the equipment needed to facilitate such environments, highly advanced technology and expertise are required. Cradle CFD has been an innovation that brought significant improvement to their design evaluation process. To help them with product development, Cradle CFD has been in use and “has played a vital role in the process,” according to Mr. Masahiro Shigemori, Chief of Ventilation Technology Development Division, Thermo-Fluid Development Department, R&D Head Office (Picture).

## Ceiling Fans Designed by Fluid-Structural Co-Simulation

Ceiling fans are popular in southeast Asia and middle east countries. The Company has provided various types of ceiling fans according to design preferences and feature requirements in each country (Figure 1).

Ceiling fans are given safety measures such as falling prevention. Mr. Shigemori says that ceiling fans can be damaged or can crash to the floor by blade vibration, and in some cases by wind from air-conditioners, which could add wind pressures (external pressures) when hitting the fan. Caution notices are written on fan manuals, but as fans can be allocated near air-conditioners, the Company needs to validate safety by simulations.

As the analysis involved calculating the force applied to fan blades and how they could deform blades, the Company has been using co-simulations of fluid and structural analysis. To perform, Software Cradle’s scFLOW and MSC Software’s

Malaysia



India



Middle East



Figure 1: Ceiling fans provided across countries

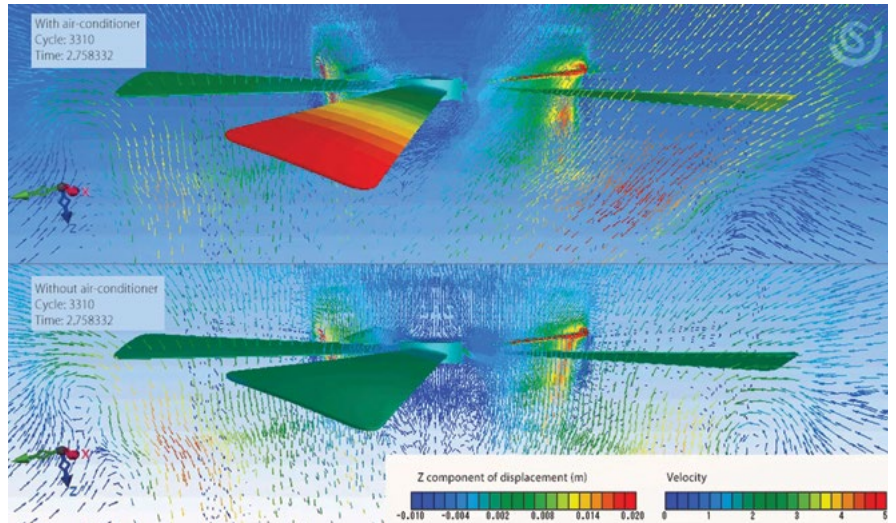


Figure 2: **Transient deformation of ceiling fan caused by air-conditioner wind**

MSC Nastran have been in use. These were initially devised separately, and data import was inconvenient. The recently introduced MSC Co-Sim engine has enabled better connection and control.

Values of pressure on blade surfaces evaluated by scFLOW are provided to MSC Nastran, and in reverse, the degree of deformation evaluated by MSC Nastran are provided to scFLOW. From this, where and when deformation and vibration could take place can be evaluated. Result comparison shows that fans rotate at stable rates of deformation when there is no external force (bottom of Figure 2), whereas when there is wind from air-conditioners, the fan blade vibrates in a complicated manner (top of Figure 2). “We can observe the complicated behavior by looking at simulation results in animation format,” says Mr. Shigemori.

Applying simulation technology and evaluating models in the conditions and environments that products are actually used, the Company achieved safety validation of products as well as its performance improvement.

### Future Challenges

Going forward, Mr. Shigemori comments: “We have been applying simulations for qualitative comparison and evaluations, but we are hoping to improve accuracy and one day apply it for qualitative

evaluations. Another goal is to expand the areas of co-simulation.”

It is certain that the Company will continue to pursue IAQ improvement through innovative research and development.



Mr. Masahiro Shigemori, Panasonic