SC/Tetra

Cradle
MSC Software Company

Assessing the Capability of Water Lens Turbine for Tidal Power Generation

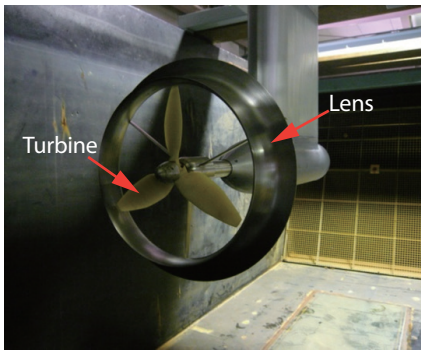
Case Study for Kyushu University

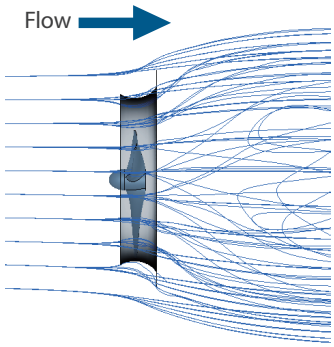
SC/Tetra shows that the power coefficient is significantly increased by attaching a lens to a water turbine

Background

Tidal power generation is considered as the most promising approach for marine renewable energy development. Various researches have been made on its energy efficiency.

The "wind lens" turbine, developed by Professor Ohya from Kyushu University, has a ring-shaped diffuser along the outer edge of its blades and is known to be effective in improving energy efficiency. Using this technology, the "water lens" turbine was developed to create the same effects in tidal power generation. In this case study, analyses were performed to evaluate performance of a water turbine with and without the lens and to compare flow distributions and power coefficients.

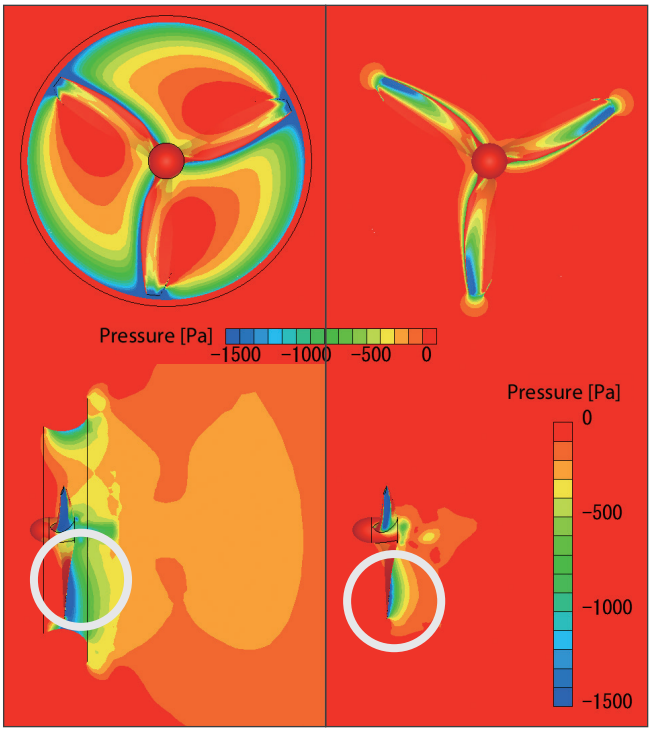




Simulation results

Pressure distribution

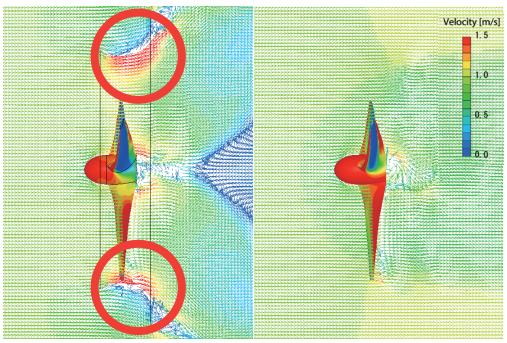
With lens | Without lens



With lens, pressure difference across the turbine in the flow direction is greater

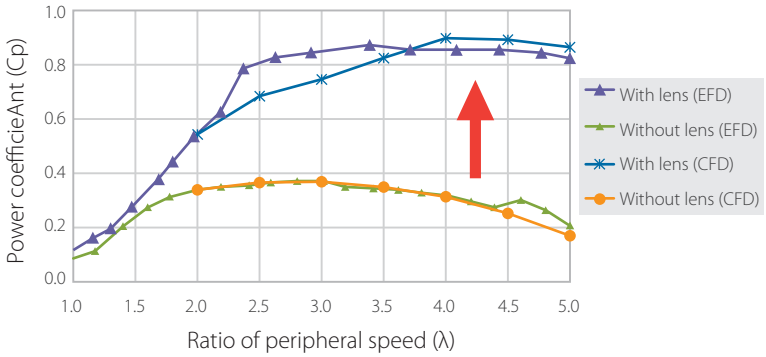
Velocity distribution

With lens | Without lens



With lens, flow velocity becomes higher due to the diffuser effect

Comparison between analysis and experiment results



Both analysis and experiment results show that the power coefficients increase by more than double when the lens is attached

Customer Comments

Moving element function of SC/Tetra was used to analyze turbine models with and without the lens. SC/Tetra enabled visualization and verification of the difference caused by effects of the lens diffuser in flow velocity and pressure distribution. Power coefficients, used as indices for power generating efficiency of turbines, were estimated by CFD calculations. Comparison between the cases with and without the lens showed that the power coefficient value was more than doubled with the lens. The experiment result showed a similar pattern. This validates that CFD can be used to assess capability of the water lens turbine effectively.