Performance Prediction and Stability Analysis Considering Hydrodynamic Characteristics of the Horizontal Axis Tidal Turbine

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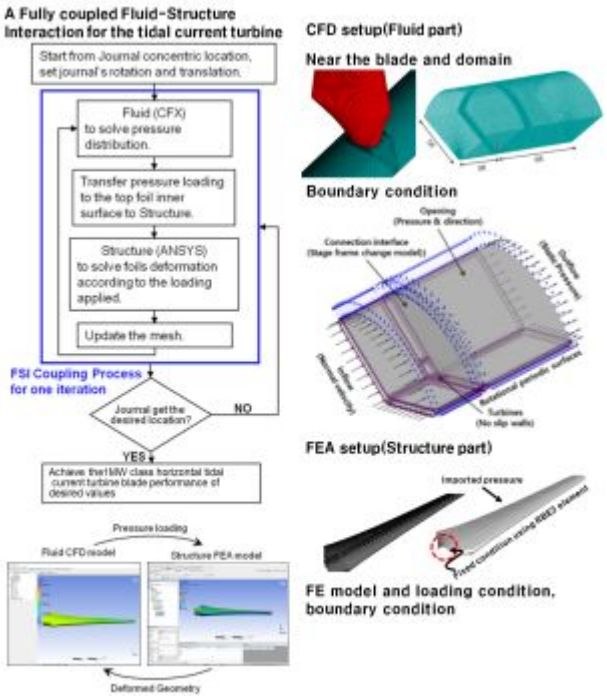
Key Words : Horizontal Axis Tidal Turbin, Tip Speed Ratio, Attack angle, Fluid-Structure Interaction Analysis, Blade

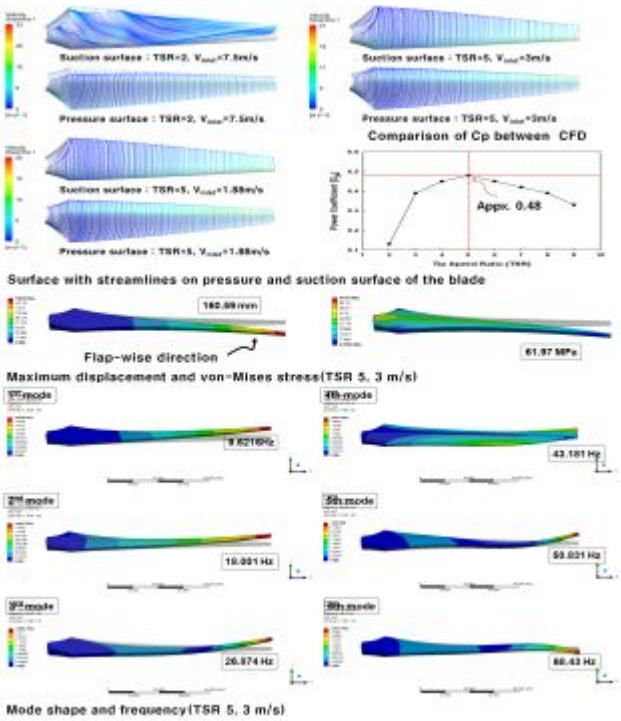
1. Introduction

In this paper, the structural safety of the three dimensional blade shape is analyzed using the one way fluid structure interaction. The three dimensional blade shape is used for the 1MW horizontal axis tidal turbine. The three dimensional blade shape is designed using the blade element momentum theory. The pressure data of the three dimensional blade shape derived from the computational fluid dynamics. The press data are included in the structural analysis model. In this paper, the one way FSI uses to apply to the pressure data in the structural analysis model. The structural strength of the three-dimensional blade shape was evaluated by comparing to the maximum equivalent stress with the yield strength of the material properties.

2. Numerical Method



3. Results



4. Conclusions

The conclusions were derived from the performance analysis due to TSR variables in the order to evaluate a performance of the horizontal Axial Tidal Turbines. For structural verification of tidal current turbine blades, strength analysis should generally be considered and should also be evaluated a dynamic problem such as resonance phenomenon. The maximum value of the power coefficient (Cp) =0.48 was obtained at the TSR 5. In the case of the suction surface, a complex surface streamline was formed in the overall area at TSR 2. Linear static structural analysis can be performed to establish a standard for judging the safety of this blade (failure criterion: Tsai-Wu criteria). Natural frequency analysis was performed to examine the resonance of the structure (modal analysis, Campbell diagrams of resonance check). Performance prediction of the tidal current turbine blade is very important and more economical prior to the fabrication and installation of the turbine.

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