CFD를 이용한 수직축 터빈 설계 및 유동특성 분석

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Vertical Axis Tidal Turbine Design and CFD hydrodynamic Analysis

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Due to the global warming, the need to secure the alternative resources has become more important worldwide. Having very strong current on the west coast with up to 10 m tidal range, there are many suitable sites for the application of TCP(Tidal current power) in Korea. Not only from the current produced from the high tidal range, but also it can be widely applied to the offshore jetties and piers. The VAT(Vertical axis turbine) system could be very effective tidal device to extract the energies from the attacking flow to the structures. For the relatively slow current speed, the VAT system could be more effective application than HAT(Horizontal axis turbine) device. The performance of VAT can be evaluated by various parameters including number of blades, shape, sectional size, diameters and etc. The paper introduces the multi-layer vertical axis tidal current power system with savonius turbine. The turbine was designed with consideration of optimal blade numbers and the performance was simulated by CFD analysis.

Key words : TCP(Tidal Current Power: 조류발전), Renewable energy(신재생 에너지), VAT(Vertical Axis Turbine: 수직축 터빈), CWC(Circulating Water Channel: 회류수조), Savonius turbine(사보니우스 터빈), CFD (Computational Fluid Dynamics: 전산유체역학)

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500kW 조류력 발전장치 개발 및 울돌목 실증시험

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Development of 500kW Tidal Current Energy Converter and Uldolmok Field Test

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Hyundai Heavy Industries has developed a tidal current energy converter utilizing the accumulated technology as the world largest constructor for ship and offshore structures. The model has two sets of turbines in both ends in order to utilize the bi-directional current flows in flood and ebb tide. The torque produced by turbine in tidal current is directly delivered to generator along the horizontal axis, in which the turbine, gear, generator, gear and turbine are connected successively. The manufactured model for field test has the turbine diameter of 5 meters to produce the maximum power of 500kW at maximum current speed of 5m/s.

The technical verification of tidal power converter was performed by means of small scale model test in towing tank as well as field test at the Strait of Uldolmok located in Jindo of Jeollanamdo province. Field test was performed by mounting the tidal current converter on the SEP(Self Elevating Platform) which could lower the 4 vertical legs on the seabed and could elevate platform over the water surface using the hydraulic power for itself. The field test performed for a month shows that power output is similar or larger compared with the expected one in design stage.

This paper presents the development of tidal current energy converter and real sea field test by Hyundai Heavy Industries. This project has finished successfully and provided the technical advance toward commercial services for tidal current power generation in the south-west region in Korea.

Key words : Tidal Current Energy Converter(조류력 발전장치), Bi-directional Paired Turbines(양방향 쌍수차), Horizontal Axis Direct Drive Type(수평 직결식 동력 전달 방식), Model Test(모형시험), Field Test(실증시험), Self Elevating Platform(자가 승강식 해상설치선), Pile Drilling(말뚝 천공), Mooring(계류)

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