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소형 풍력 블레이드 공력 설계를 위한 표준 절차 구축

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Standard Procedure for the Aerodynamic Design of Small Wind Turbine Blades

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Abstract : There have been many academic researches on the aerodynamic design of wind turbine based on blade element method (BEM) and momentum theory (MT, or actuating disk theory). However, in the real world, the turbine blade design requires many additional constraints more than theoretical analysis. The standard procedure is studied in the present paper to design new blades for the wind turbine system ranged from the small size from 1 to 10 kW. From the experience of full design of a 10 kW blade, the authors tried to set up a standard procedure for the aerodynamic design based on IEC 61400-2. Wind-turbine scale, rotating speed, and geometrical chord/twist distribution at the segmented span positions are calculated with a suitable BEM/MT code, and the geometrical shape of tip and root should be modified after considering various parameters: wing-tip vortex, aerodynamic noise, turbine efficiency, structural safety, convenience of fabrication, and even economic factor likes price, etc. The evaluated data is passed to the next procedure of structural design, but some of them should still be corresponded with each other: the fluid-structure interaction is one of those problems not yet solved, for example. Consequently, the design procedure of small wind-turbine blades is set up for the mass production of commercial products in this research.

Key words : Wind turbine, Aerodynamic design, Small wind turbine, Aerodynamics, Standard procedure

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