Proceedings of the Eighteenth (2008) International Offshore and Polar Engineering Conference
Vancouver, BC, Canada, July 6-11, 2008

ISBN 978-1-880653-70-8 (Set); ISBN 1-880653-68-0 (Set)

Intelligent Wind Turbine Unit with Tandem Wind Rotors Applicable to Offshore Wind Farm (Profiles and Performances as Tandem Wind Rotors)

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ABSTRACT

The authors invented the superior wind turbine unit, which is composed of the tandem wind rotors and the double rotational armature type peculiar generator without the traditional stator. It was verified experimentally, at the previous ISOPE conferences, that the output of this unit is higher than the output of the conventional wind turbine and that the rear wind rotor plays very important role to improve the performances of the tandem wind rotors. Continuously, this paper discusses the effect of the blade profiles of the wind rotors on the output characteristics and investigates the acoustic noise from the wind rotors. The field tests were also started preliminarily using the proto type unit composed of the front wind rotor of 2 m, the rear wind rotor of 1.33 m, and the double rotational armature type synchronous generator which are boarded on a pickup vehicle.

KEY WORDS: Wind turbine; generator; offshore wind farm; tandem rotors; acoustic noise.

INTRODUCTION

Wind is clean, renewable and homegrown energy source of electric power generation, and has been positively/effectively utilized to cope with the global warming environment. The conventional wind turbines have some weak points as follows. The large-sized wind rotor generates higher output at the moderate wind speed, but it cannot operate at the weak wind. The small-sized wind rotor is suitable for weak wind, but the output is smaller. That is, the size of the wind rotor must be correctly/appropriately selected in conformity with the wind circumstances. Moreover, the blade of the wind rotor must be equipped with the brakes and/or pitch control mechanisms, in general, to suppress the abnormal rotation and the generated overload at the strong wind, and to keep good quality of the electric power supply. To overcome these weak points, the authors have invented the superior wind turbine unit (kanemoto et al., 2005), as shown in Fig. 1. This unit is composed of the large-sized front wind rotor, the small-sized rear wind rotor and the peculiar generator with the inner and the outer armatures without the traditional stator. The front and rear wind rotors drive the inner and the outer armatures respectively as shown in Fig. 1. The rotational directions and the speeds of both wind rotors/armatures are free, and automatically determined pretty well in response to the wind circumstances. Then, this unit is called "**Intelligent Wind Turbine Unit**" by the authors. The superior power generation of the unit was verified in the previous report (Kanemoto et al., 2005, 2006, 2007), and the characteristics of the double rotational armature type doubly fed induction generator were investigated for supplying this unit to the power grid system (Kanemoto et al., 2007). Continuously, this paper discusses the effect of the wind rotor profiles (Front and Rear wind rotors) on the turbine characteristics, and investigates the acoustic noise from the wind rotors. Besides, the field tests are also started preliminarily using the proto type unit composed of the front wind rotor of 2 m, the rear wind rotor of 1.33 m, and the double rotational armature type synchronous generator which are boarded on a pickup type vehicle.

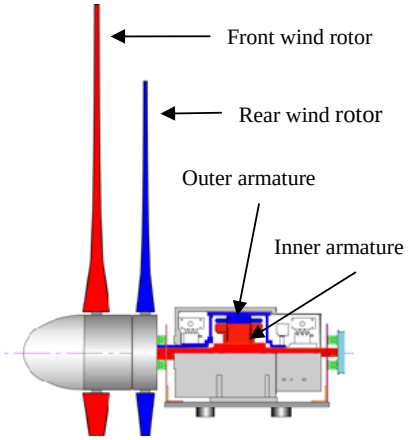

Fig.1 Concept of Intelligent Wind Turbine Unit

SUPERIOR OPERATION OF TANDEM WIND ROTORS

The operation of tandem wind rotors is in cooperation with the double rotational armature type generator, as shown in Fig. 2. The rotational directions and the speeds of tandem wind rotors/armatures