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Performances and Acoustic Noise of Model Intelligent Wind Power Unit

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Abstract. The authors invented the superior wind power unit which is composed of the tandem wind rotors and the double rotational armature type generator without the traditional stator. The large-sized front wind rotor and the small-sized rear wind rotor drive the inner and the outer rotational armatures respectively, as for the upwind type. The unique rotational conditions of the tandem wind rotors and the fundamental performances were presented at the previous papers. Continuously, this paper discusses experimentally the effect of the blade profiles of tandem wind rotors on the performances and investigated the acoustic noise emitted from tandem wind rotors. The output of the tandem wind rotors with the desirable profiles is higher than the output of the traditional single wind rotor. The acoustic noise is induced mainly from the flow interaction between the front and the rear wind rotors, and is dominant at the blade passing frequency.

Key words
Wind Turbine, Wind Energy, Tandem Wind Rotors, Counter-Rotation, Performance, Acoustic Noise

1. Introduction
Wind is clean, renewable and homegrown energy resource for the electrical power generation, and has been utilized effectively to cope with the warming global environment. The traditional wind turbines with the large sized wind rotor generate the high output at the moderate wind velocity, but do not operate at the weak wind, in general. The small-sized wind rotors are suitable for the weak wind, but the output is small. 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, not only to suppress the abnormal rotation and the generated over load at the strong wind but also to keep good quality of the electric power supply. To overcome these weak points of the traditional wind turbines, the authors invented the superior wind power unit [(1)], 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 rotational armatures without the traditional stator. As for the upwind type, the front and the rear wind rotors drive the inner and the outer rotational armatures, respectively. The rotational speeds and the directions of both wind rotors/armatures are free, and automatically adjusted pretty well in response to the wind circumstances while the rotational torques between both wind rotors/armatures are counter balanced. This unit is named **"Intelligent Wind Power Unit"** by the authors. The concepts of the tandem wind rotors have been proposed before. For example, Professor I. Ushiyama could increase the output using the model tandem wind rotors [(2)]. Kowintec Co. Ltd. has succeeded only to increase the output of the prototype wind turbine with the gearbox [(3)]. On the contrary, the unit proposed

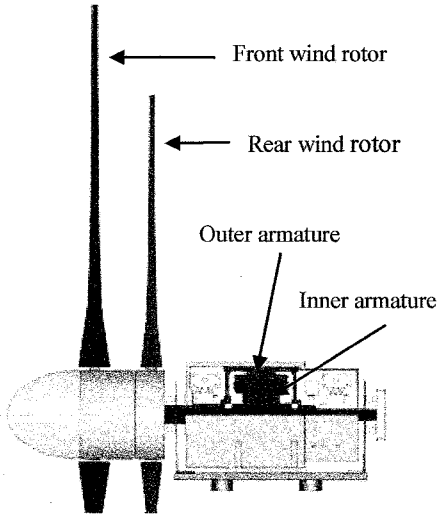

Fig.1 Upwind type Intelligent Wind Power Unit