

The development of compact wind power generation system with windbreak function.



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Keywords	Switched Reluctance Generator, Renewable Energy, Power Electronics
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Technical Support Skills	<ul style="list-style-type: none"> • Analysis and design of power generation system using a switched reluctance generator. • Design of control circuit using FPGA. • Magnetic circuit analysis using Reluctance Network Analysis(RNA) and FEM.
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Research Contents Reduce the wind and snow damages in Shonai area, and effective use of wind power

A lot of wind-snow protection fences are installed along the road in the Shonai area to avoid blizzard. By incorporating a wind energy absorption-type windmill and the generator into wind-snow protection fences, not only weaken the blizzard, but decrease the energy of the strong wind and effective use of the generated power. Power obtained from the generator would like to use ensure the traffic safety, and so on. The wind turbines used in this study are those developed at the Tohoku Institute of Technology's Nozawa laboratory shown in Figure 1 and the four-bladed wind turbine of Fig. 2 developed in this laboratory. The blades of the wind turbine of Fig. 1 is made of aluminum, and the blades of Fig. 2 is wooden. Both windmills, which greatly slow down the wind speed, are structured like a vertical axis type gyro mill type wind turbine mounted sideways. The dimension of the wind receiving surface is 600 [mm] in width and 400 [mm] in length. As a device to generate strong wind, I used a fan installed on the left side of Fig. 2. The wind speed rang is from 0 [m / s] to about 10 [m / s]. As a generator, we used a compact 5-phase stepping motor, and connected the rectifier circuit to the output of the generator to take out the output with direct current.

Fig.3 shows the relationship between wind speed and generator output power. The load resistance was set to 100 [Ω], 200 [Ω], 300 [Ω]. You can see that the output power is rising in proportion to the wind speed. When we measured the wind speed at the position of about 50 [cm] behind the wind turbine and the backward direction, the wind speed decreased by 60 to 90 [%]. Compared with windbreak snow fences installed in national roads, there was a speed reduction effect of 2 to 3 times wind speed. Experimental results showed that the output power of the wind turbine with respect to the wind speed was larger for the two lighter weight blades, and there was almost no difference in the wind speed deceleration effect. In the future I would like to consider reducing the starting torque of the generator, raising the output, how to utilize the output power, and so on.

Ultimately, we plan to develop a permanent magnet built-in reluctance generator with a new structure with the function to make use of the characteristics of the wind turbine.



Fig.1 Two-blades wind mill



Fig.2 Four-blades wind mill

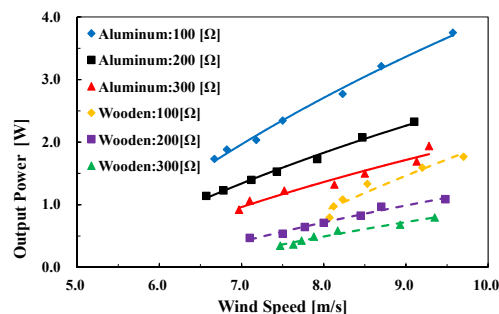


Fig.3 Output characteristics

Available Facilities and Equipment
