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# SMALL-SCALE WIND TURBINE DESIGNED FOR THE WIND CONDITION OF SALINOPÓLIS

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**Abstract:**

Small wind turbines are in general subjected to low wind speeds. These conditions are common in the city of Salinópolis, state of Pará, whose wind potential has been studied by Frade (2000), which demonstrated that in this locality the wind speed is about 6 m/s. In this work, the computational code proposed by Vaz et al. (2011) is used to optimize a turbine blade geometry using the airfoil NACA 654421. Power output and other parameters regarding the operating condition of the turbine are also performed. Prandtl's equations are employed to correct the effects of vortices on the tip and root of the blade, as well as Glauert's correction to calculate the optimal induction factors. The pos-stall correction through Viterna and Corrigan model is included in the classical Blade Element Momentum Theory. Hence, it is possible to obtain optimized chord and twist angles of the rotor blade, as can be observed in Figure 1. The power output as a function of wind speed using the optimized blade is shown in Figure 2. Note that at nominal speed, there is an energy production exceeding 800 W. When the wind condition is more than 8 m/s, the generated energy approaches 1200 W, remaining constant. Thus, the design of a wind turbine to generate energy at low wind conditions using Blade Element Momentum Theory is very interesting, demonstrating that it is possible to use this type of technology for small-scale energy production.

**Key-words:** Optimized Blade, Blade Element Momentum, Low wind speed, Wind Turbine.

Figure 1 – Optimized blade shape.

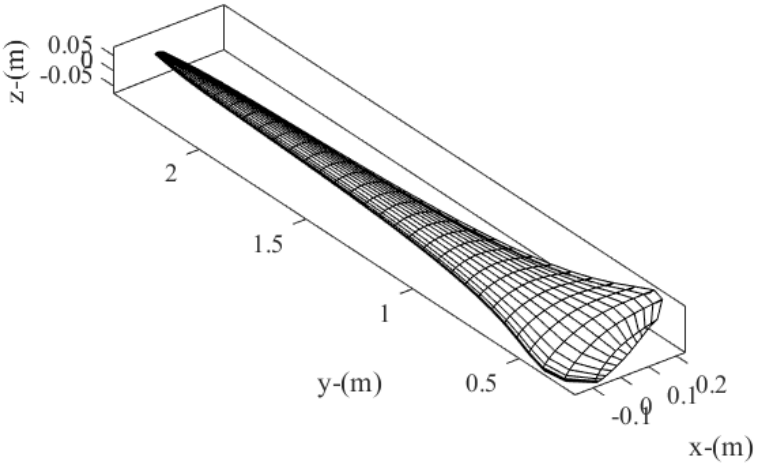
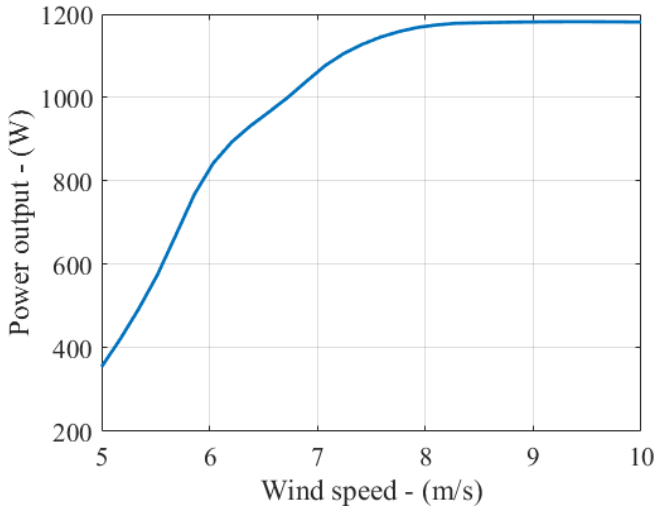



Figure 2 – Power generated by the turbine according to the wind speed.

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