Blade Optimization for Ground Level Low Speed Wind Turbines

Low speed wind turbines can provide inexpensive and clean energy in areas where large scale wind power generation is impractical. The purpose of this research is to explore factors that affect the efficiency of low speed wind turbines. The factors that were tested are span, chord length, angle of twist, taper ratio, average thickness, and sweep angle. The goal is to determine a combination of these variables to enable maximum power extraction from a low wind speed source. These parameters are optimized for the Southeastern region of the United States. NOAA weather data at ground level are used to determine average wind speeds. The optimized wind turbine will be suitable for residential or small commercial uses. Testing is done using an analytical physics-based model, Computational Fluid Dynamics (CFD), and wind tunnel testing with 3D printed fan blades. Testing on 3D printed blades was done to validate the accuracy of the analytical physics-based model and Computational Fluid Dynamics testing.