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Design of Shrouded Airborne Wind Turbine & CFD Analysis
FAIQA ANBREEN, REZA TOOSSI, Cal State Univ- Long Beach, FAIQA ANBREEN COLLABORATION — The focus is to design a shrouded airborne wind turbine, capable to generate 70 kW to propel a leisure boat. The idea of designing an airborne turbine is to take the advantage of different velocity layers in the atmosphere. The blades have been designed using NREL S826 airfoil, which has coefficient of lift C_L of 1.4 at angle of attack, 6°. The value selected for C_P is 0.8. The rotor diameter is 7.4 m. The balloon (shroud) has converging-diverging nozzle design, to increase the mass flow rate through the rotor. The ratio of inlet area to throat area, A_i/A_t is 1.31 and exit area to throat area, A_e/A_t is1.15. The Solidworks model has been analyzed numerically using CFD. The software used is StarCCM+. The Unsteady Reynolds Averaged Navier Stokes Simulation (URANS) K-ε model has been selected, to study the physical properties of the flow, with emphasis on the performance of the turbine. Stress analysis has been done using Nastran. From the simulations, the torque generated by the turbine is approximately 800N-m and angular velocity is 21 rad/s.

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