Design and experimentation of 3D-printed Tesla Turbine

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Abstract

The long-term objective of this project is to understand better design factors that maximize the efficiency and power output of mini tesla turbines. In the current project, focus will be given on the design and experimentation of 3d-printed Tesla turbine prototype. Solidworks CAD software was used to generate the 3D model and stl files required by the 3d printer. The printing was done using a STRATASYS 3D printer available in the department. The prototype incorporates six discs inside the turbine and are 4 inches (101.6 mm) in diameter and approximately 1 millimeter thick. The spacing between each of the disks is 2 millimeters. The overall size of the turbine is 4”x1”x3.25”. Water was used in the experiment and measurement was conducted to assess the flow rate and the revolutions per minute (RPM) of the central turbine shaft. It was found that the RPM is increasing exponentially with respect to the flow rate. Computational Fluid Dynamic analysis, utilizing the CAD model to generate the fluid domain, was conducted using COMSOL Multiphysics® software to estimate the flow behavior inside the casing. From the experimentation of this project we learned how the incremented flow rates will affect the RPM of the turbine shaft. We expect to use both the experiment and CFD analysis to better understand how the turbine design affect the flow characteristic and power production. Further experimentation and analysis of the Tesla turbine may be conducted in the near future to aid in optimization of the performance and efficiency of it.