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Design, Numerical Simulation, Fabrication and Physical Experimentation of the Tesla's Cohesion Type Bladeless Turbine

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Abstract : Design, numerical simulation, fabrication, and physical experimentation of the Tesla's Bladeless centripetal turbine for generating electrical power are presented in this research paper. 29 Pressurized air combined with water via a nozzle system is made to pass tangentially through a set of parallel smooth discs surfaces, which impart rotational motion to the discs fastened common shaft for the power generation. The power generated depends upon the fluid speed parameter leaving the nozzle inlet. Physically due to laminar boundary layer phenomena at smooth disc surface, the high speed fluid layers away from the plate moving against the low speed fluid layers nearer to the plate develop a tangential drag from the viscous shear forces. This compels the nearer layers to drag along with the high layers causing the disc to spin. Solid Works design software and fluid mechanics and machine elements design theories was used to compute mechanical design specifications of turbine parts like 48 mm diameter discs, common shaft, central exhaust, plenum chamber, swappable nozzle inlets, etc. Also, ANSYS CFX 2018 was used for the numerical 2 simulation of the physical phenomena encountered in the turbine working. When various numerical simulation and physical experimental results were verified, there is good agreement between them 6, both quantitatively and qualitatively. The sources of input and size of the blades may affect the power generated and turbine efficiency, respectively. The results may change if there is a change in the fluid flowing between the discs. The inlet fluid pressure versus turbine efficiency and the number of discs versus turbine power studies based on both results were carried out to develop the 8 relationships between the inlet and outlet parameters of the turbine. The present research work obtained the turbine efficiency in the range of 7-10%, and for this range; the electrical power output generated was 50-60 W.

Keywords : tesla turbine, cohesion type bladeless turbine, boundary layer theory, cohesion type bladeless turbine, tangential fluid flow, viscous and adhesive forces, plenum chamber, pico hydro systems
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