WAYS TO OPTIMIZE MIXED FLOW TURBINES TO IMPROVE THEIR PERFORMANCE FOR USE IN INTERNAL COMBUSTION ENGINES

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The issues of intensifying technological processes and increasing the efficiency of mixed-flow turbines, which are also used in internal combustion engines, are a priority in modern mechanical engineering. The peculiarity of such turbines lies in the simultaneous presence of both axial and radial flow, and neither of these flows is negligible.

The choice of blades for mixed turbines is to achieve the required deflection with minimal losses. In addition, it is necessary that the blade function without detachment in a wide area outside the nominal operating point of the machine. Particular attention in the work was given to the study of the blade profile under the conditions related to fluid mechanics and the possibility of implementing the design. The question of the influence of the angle of deflection of the blade on the geometric shape of the blade, as well as on the performance of semi-axial turbines, was studied.

Two existing techniques in progress are available sufficiently to meet our ambitions which engage in the description of the blade geometry has been analyzed. In order to determine the blade geometry that adapts effectively to a mixed inflow turbine, a method was chosen that represents the geometry of the considered surfaces using a three-dimensional functional model using Bezier polynomials.

The code used in this study is ANSYS ICEM-CFD is based on the finite volume methods.

In addition, it was noted that the new rotor wheels under study are designed by varying the deviation blade angle (-10 °, -15 °, -20 °; -25 °; -30 ° and -35 °), which allows to completely change the camber line shape, as well as the aerodynamic blade shape. The horizontal sliding of the new camber lines has revealed that the actual length of the blade increases by increasing the deviation blade angle. Hence, the rotor becomes more prolonged and heavier. Hence, the rotor becomes more prolonged and heavier.

The abstract marks out that the investigation of the deviation blade effect is based on the operation of the rotor in three rotation speed 50%, 75%, and 100% of load, which represent successively 49000 rpm, 73500 rpm, and 98000 rpm.

Several blade geometrical forms were obtained after the variation of the deviation blade angle.

It has also been established that for the larger absolute exit kinetic energies, for values of deviation blade angle between -10° and -20°, an exhaust diffuser is recommended to use to recover a part of it into a greater expansion ratio.