عنوان مقاله:

Numerical Study of the Hydrodynamic Behavior of an Archimedes Screw Turbine by Experimental Data in order to Optimize Turbine Performance: The Genetic Algorithm

محل انتشار:

مجله مکانیک کاربردی و محاسباتی, دوره 9, شماره 4 (سال: 1402)

تعداد صفحات اصل مقاله: 16

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خلاصه مقاله:

Renewable energy could solve the problems caused by fossil fuels. The Archimedes hydro screw turbine is a potential tool for generating power from river currents. In this paper, a turbine at a scale of ۱:۶ has been made. It is installed and tested at various flow rates. The system is optimized using a genetic algorithm to achieve maximum efficiency. Due to the limitations that existed for conducting experimental tests at the optimal flow rate, the turbine at optimal flow rate is studied by CFD. In the turbine numerical simulation, the hydrodynamic characteristics of the turbine, such as rotational speed, power, torque, efficiency, and power coefficient are compared in the optimal flow rate (۲.۶ (lit/s)) and a flow rate of ۲.۴ (lit/s) (the closest flow rate to the optimal one). The results show that these values are higher in the optimal flow rate. Furthermore, the behavior of the turbine in these two conditions is compared using velocity, vorticity, pressure, and phase contours, which indicates that the velocity and pressure values are higher, and the vorticity and immersion values are lower in the optimal flow rate. Finally, for economic analysis of operating the turbine at the prototype scale as a hydropower plant, the discounted payback period for the turbine is determined, which varies between ۲.۵۵ to ۵.۹۳ years depending on the discount rate. It is also shown that operating this turbine at the prototype scale as a hydropower plant in Iran leads to currency savings of ۱۵۶۱ .

کلمات کلیدی:

Archimedes hydro screw turbine, Optimization, Genetic Algorithm, Numerical Study, Economic study