

Abstract

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Numerical Study for the Use of Different Nozzle Shapes in Micro Scale Channels for Producing Clean Energy

Nowadays, most rural and hilly areas use the small and microscale plants to produce electricity it is cheap, available and effective. Utilizing hydrokinetic turbines in flow of rivers, canal channel to produce power has been a topic of considerable interest to researchers for past years. Many countries that are surrounded by irrigation rainy channels have a great potential for developing this technology. Development of open flow microchannels that suit these countries has a main problem, which is low velocity of current appears, hence deploying nozzle in-stream open channels flow is the brilliant method for increasing the channels current flow systems' efficiency. The nozzle is believed to have an ability of concentrating the flow direction whilst increasing the flow velocity. In this study, the effects of nozzle geometrical parameters such as diameter ratio, nozzle configuration and nozzle edges shape on the characteristics of the flow in the microscale rectangular channels have been investigated numerically, using a finite volume RANSE code ANSYS CFX. The physical parameters were reported for a range of diameter ratio (d_2/d_1) from 5/6 to 1/6 and nozzle length (L_n) of 0.8 m for various nozzle shapes. We also proposed a new approach which is the use of NACA 0025 aerofoils as a deploying nozzle in channels. The results of the current study showed that, although the decrease in the nozzle diameter ratio led to an increase of the flow velocity through the channel but it can affect drastically on the flow pattern, especially the free surface, at the nozzle area, which may reduce the amount of the generated power, thus the study concluded with optimum diameter ratio, which was 2/3. The flow patterns improved with the curved edges shape the NACA shape gave the most preferable results.