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Optimal thermo aerodynamic performance of s-shaped baffled channels
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Abstract
This manuscript presents a numerical analysis of fluid flow and heat transfer in rectangular cross section channels with and without baffles using air as the working fluid at Reynolds numbers ranging from 12,000 to 32,000. Four various channel geometries were studied in this analysis. In the first case, a smooth channel with no baffle was analyzed. In the second case, a flat rectangular baffled channel was investigated, and in the third case, S-shaped baffled channels were examined (i.e., S-baffles pointed towards the upstream end: Called S-upstream baffles; and S-baffles pointed towards the downstream end: Called S-downstream baffles). The Commercial CFD software FLUENT was employed to simulate the air flow and thermal aspects in the whole domain investigated based on finite volume approach. The thermo aerodynamic performance evaluations were considered in three parts; thermal transfer, skin friction loss and thermal enhancement factor in terms of Nu/Nu0, f/f0, and TEF, respectively. In general, the normalized average Nusselt number and normalized friction factor tend to augment with the increase of the Reynolds number for all channel situations. over range studies, the improvements are found to be around 1.939 - 4.582 and 3.319 - 32.336 times upper than the smooth air channel for Nu and f, respectively. In a comparison with the flat rectangular baffle, the Nu/Nu0 and f/f0 values increase in the cases of S-upstream baffle by 14.855 % and 26.282 %, respectively at Re = 32,000. However, the Nu/Nu0 and f/f0 values decrease by 7.442 % and 41.481 % when the baffle shape is S-downstream at the same Re value, respectively. © 2018 Universiti Malaysia Pahang, Malaysia.

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