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Numerical investigation of semi-empirical relation representing nusselt number under waterjet impingement (Article)

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Abstract

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Extruded surfaces, such as pin fin, enable better heat transfer distribution when accompanied by fluid jets. A numerical study is carried out, in which a waterjet is being impinged on the pin-fin target surface, and Nusselt profile is evaluated for various impinging and geometric parameters. Impinging parameters, such as Reynolds number and nondimensional nozzle-surface distance, are varied, whereas geometric parameters, such as nondimensional pin-fin height and nondimensional pin-fin spacing, are being subjected to variation. The local Nusselt magnitudes evaluated for different impinging and geometric parameters are plotted against nondimensional radial distance of the target surface. Regression analysis is carried out and semi-empirical relations are proposed for local Nusselt number magnitude in terms of impinging and geometric parameters. The correlations are well validated against the results of previous literature studies. In addition, grid independence test and turbulence modelling test are performed to obtain a model that can predict accurate results. It is found that the shear stress transport γ – θ model predicts the most accurate results.

SciVal Topic Prominence

Topic: Heat Sinks | Fins | Forced Convection

Prominence percentile: 91.223

Indexed keywords

Engineering controlled terms: Fins (heat exchange) | Geometry | Jets | Regression analysis | Reynolds number | Shear stress

Engineering uncontrolled terms: Heat transfer distributions | Independence tests | Literature studies | Local Nusselt number | Numerical investigations | Radial distance | Semiempirical relations | Shear-stress transport

Engineering main heading: Nusselt number

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