



Document details

< Back to results | 1 of 4 Next >

[↗](#) Export [↓](#) Download [🖨](#) Print [✉](#) E-mail [📄](#) Save to PDF [★](#) Add to List [More... >](#)

[Full Text](#) View at Publisher

Journal of Thermophysics and Heat Transfer
Volume 34, Issue 3, 2020, Pages 579-590

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

Siddique, U.^a, Ansari, E.^b, Khan, S.A.^c, Patil, R.^a

^aNMIMS University, Department of Mechanical Engineering, Mukesh Patel School of Technology Management & Engineering, Mumbai, 400 056, India

^bUniversity of Science, School of Aerospace Engineering, Penang 14300, Malaysia

^cInternational Islamic University of Malaysia, Department of Mechanical Engineering, Kuala Lumpur, 53100, Malaysia

Abstract

[View references \(35\)](#)

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 $\gamma - \theta$ model predicts the most accurate results. © 2020 by the American Institute of Aeronautics and Astronautics, Inc. All rights reserved.

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](#)

Metrics [ⓘ](#) [View all metrics >](#)

1 Citation in Scopus
83rd percentile
1.59 Field-Weighted
Citation Impact

Cited by 1 document

Numerical investigation of mathematical non-dimensional constant representing smoothness in the nusselt profile

Ansari, E. , Siddique, U. , Khan, S.A.
(2020) *CFD Letters*

[View details of this citation](#)

Inform me when this document is cited in Scopus:

[Set citation alert >](#)

Related documents

Study on thermal performance of cold plate unit with micro-channel for supercomputer cooling

Wiriyasart, S. , Naphon, P.
(2018) *JP Journal of Heat and Mass Transfer*

Enhancement of confined air jet impingement heat transfer using perforated pin-fin heat sinks

Farhad Ismail, M. , Saha, S.C.
(2018) *Green Energy and Technology*

Heat transfer enhancement from micro pin fins subjected to an impinging jet

Ndao, S. , Lee, H.J. , Peles, Y.
(2012) *International Journal of Heat and Mass Transfer*




[View all related documents based on references](#)

ISSN: 08878722
CODEN: JTHTE
Source Type: Journal
Original language: English

DOI: 10.2514/1.T5947
Document Type: Article
Publisher: American Institute of Aeronautics and Astronautics Inc.

References (35)

[View in search results format >](#)

All | [Export](#)  [Print](#)  [E-mail](#)  [Save to PDF](#) [Create bibliography](#)

-
- 1 Chapman, Christopher L., Lee, Seri, Schmidt, Bill L.
Thermal performance of an elliptical pin fin heat sink
(1994) *Proceedings - IEEE Semiconductor Thermal Measurement & Management Symposium*, pp. 24-31. Cited 62 times.
[View at Publisher](#)
-
- 2 Copeland, D.
Single-phase and boiling cooling of small pin fin arrays by multiple nozzle jet impingement
(1996) *Journal of Electronic Packaging, Transactions of the ASME*, 118 (1), pp. 21-26. Cited 16 times.
doi: 10.1115/1.2792122
[View at Publisher](#)
-
- 3 Brignoni, L.A., Garimella, S.V.
Experimental optimization of confined air jet impingement on a pin fin heat sink
(1999) *IEEE Transactions on Components and Packaging Technologies*, 22 (3), pp. 399-404. Cited 90 times.
doi: 10.1109/6144.796542
[View at Publisher](#)
-
- 4 El-Sheikh, H.A., Garimella, S.V.
Enhancement of air jet impingement heat transfer using pin-fin heat sinks
(2000) *IEEE Transactions on Components and Packaging Technologies*, 23 (2), pp. 300-308. Cited 71 times.
doi: 10.1109/6144.846768
[View at Publisher](#)
-
- 5 El-Sheikh, H.A., Garimella, S.V.
Heat transfer from pin-fin heat sinks under multiple impinging jets
(2000) *IEEE Transactions on Advanced Packaging*, 23 (1), pp. 113-120. Cited 43 times.
doi: 10.1109/6040.826769
[View at Publisher](#)
-
- 6 Li, H.-Y., Chen, K.-Y.
Thermal-fluid characteristics of pin-fin heat sinks cooled by impinging jet
(2005) *Journal of Enhanced Heat Transfer*, 12 (2), pp. 189-201. Cited 17 times.
doi: 10.1615/JEnhHeatTransf.v12.i2.40
[View at Publisher](#)
-