# INVESTIGATION OF THERMAL ENHANCEMENT IN A WAVY CHANNEL WITH CIRCULAR CYLINDERS

# Selma Akçay1\*, Nijat Sadıgov2

**1Çankırı Karatekin University, Engineering Faculty, Department of Mechanical Engineering, Çankırı, Türkiye**

**2Çankırı Karatekin University, Undergraduate Student of Mechanical Engineering, Çankırı, Türkiye**

*\**1**Orcid ID: 0000-0003-2654-0702**

*\*Corresponding author: selmaakcay@karatekin.edu.tr*

|  |
| --- |
| **ABSTRACT**  The combined use of wavy surfaces and vortex generators is a common practice to increase heat transfer improvement [1, 2]. These applications are widely used in many thermal devices, especially in heating and cooling processes [3]. Numerical and experimental works have declared that higher thermal enhancement are obtained in these applications compared to flat channels due to the higher heat transfer area and flow mixing [4-5]. However, wavy channels and vorteks generations slightly increase the pumping power [6]. The present study numerically investigates the flow and thermal enhancement in a circular wavy channel with different positions of circular cylinders. Solutions are conducted using ANSYS Fluent program with standard k-ε turbulence model. The pressure-velocity relation is handled with the SIMPLE algorithm. In the study, three different channel flows are examined: Channel 0 (without cylinder), Channel 1 (with one circular cylinder), and Channel 2 (with two circular cylinder). There are adiabatic flat parts at the inlet and outlet of the channel. The circular wavy surfaces of the channel are kept at a constant temperature of Ts=340K. The working fluid is air. Nusselt number (Nu), pressure drop (𝛥P), friction factor (f), and thermal enhancement factor (TEF) are found for different Reynolds numbers (2000 ≤ Re ≤ 8000). The numerical work is compared with previous study results. To observe the effects of the circular wavy channel and the circular cylinders on the flow and temperature fields, the velocity and temperature contours are obtained, and the results are discussed. In addition, the study results are compared to the flat channel. Numerical results show that the circular wavy channel increased the Nusselt number. However, the presence of circular cylinders causes a slight increase in friction factor. The highest heat transfer was found as Nu = 11.62 in Channel 1 at Re = 8000. The highest-pressure drop was obtained to be ΔP= 20.05 Pa in Channel 1 at Re=8000.  **References:**  [1] Ajarostaghi SSM, Zaboli M, Javadi H, Badenes B, & Urchueguia JF. (2022). A review of recent passive heat transfer enhancement methods. Energies, 15, 986.  [2] Kurtulmus N, Sahin B. (2019). A review of hydrodynamics and heat transfer through corrugated channels. International Communications in Heat and Mass Transfer, 108, 104307.  [3] Nitturi LK, Kapu VK, Gugulothu R, Kaleru A, Vuyyuri V, & Farid A. (2023). Augmentation of heat transfer through passive techniques. Heat Transfer, <https://doi.org/10.1002/htj.22877>  [4] Alfellag M A, Ahmed H E, Jehad M G, Farhan A A., 2022. The hydrothermal performance enhancement techniques of corrugated channels: A review. Journal of Thermal Analysis and Calorimetry, 147: 10177-10206.  [5] Akçay S. (2023). Numerical analysis of hydraulic and thermal performance of Al2O3-water nanofluid in a zigzag channel with central winglets. Gazi University Journal of Science, 36 (1), 383-397.  [6] Salami M, Khoshvaght-Aliabadi M, Feizabadi A., 2019. Investigation of corrugated channel performance with different wave shapes. Journal of Thermal Analysis and Calorimetry, 138: 3159-3174.  [7] Choudhary T, Sahu MK, Shende V, & Kumar A. (2022). Computational analysis of a heat transfer characteristic of a wavy and corrugated channel. *Material Today: Proceedings,* 56, 263-273. |

# Keywords: Circular wavy channel, circular cylinder, Pressure drop, Termal enhancement, Turbulent flow.