ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
ΤΜΗΜΑ ΜΗΧΑΝΟΛΟΓΩΝ ΚΑΙ ΑΕΡΟΝΑΥΠΗΓΩΝ ΜΗΧΑΝΙΚΩΝ
ΤΟΜΕΑΣ ΕΝΕΡΓΕΙΑΣ, ΑΕΡΟΝΑΥΤΙΚΗΣ ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ
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ΣΤΑΤΙΣΤΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

ΣΠΟΥΔΑΣΤΙΚΗ ΕΡΓΑΣΙΑ

Methodology for theoretical and experimental evaluation of double-pipe heat exchangers with internal grooves

Arampatzis Christos

1070524

Επιβλέπων: Ρωμαίος Αλέξανδρος, Επίκουρος καθηγητής

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ABSTRACT

This study examines the theoretical and experimental evaluation methodology of double-pipe heat exchangers with internal grooves. Heat exchangers are critical components in heat transfer between fluids and are widely used in industry and energy systems. This research focuses on the study of internal grooves, which enhance heat transfer by increasing turbulent flow and reducing the thermal boundary layer.

Initially, a literature review of related studies and experiments is presented, followed by the theoretical framework covering heat transfer, Nusselt and Reynolds numbers, and the significance of internal grooves in thermal performance. The methodology describes calculations of the convection coefficient, Nusselt number, and friction factor, along with the experimental procedure for data collection.

As part of this research, a proposed experimental setup enables the evaluation of the thermal performance of double-pipe heat exchangers with and without internal grooves. This setup allows for a direct comparison between the two cases, providing valuable insights for improving heat exchanger efficiency.

The results compare the thermal performance of smooth and grooved pipes, confirming the improved heat transfer in the latter. Additionally, the impact of pressure drop and overall heat exchanger efficiency is analyzed. In conclusion, the use of grooves is an effective strategy for improving the thermal efficiency of double-pipe heat exchangers, making them more suitable for industrial and energy applications.

Keywords: Heat Transfer, Double-Pipe Heat Exchangers, Internal Grooves, Nusselt Number, Friction Factor