

# **FLOW AND HEAT TRANSFER CHARACTERISTICS THROUGH NARROW VERTICAL RECTANGULAR CHANNELS**

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## **ABSTRACT**

The purpose of this work is to study the flow and heat transfer characteristics through narrow vertical rectangular channels. This type of flow finds its important application especially in the plate fuel type nuclear reactors. The experimental study is carried out on a test section consisting of a narrow vertical rectangular channel heated from both sides and has the same dimensions as that of the coolant channel formed between two adjacent fuel plates in the core of the Egyptian nuclear research reactor.

The channel is made of two stainless steel plates, which are electrically heated and thermally insulated. This experimental study aims to:

- 1) Determine the applicability and validity of the existing correlations for turbulent forced convection heat transfer.
- 2) Determine the flow and heat transfer characteristics along the channel for different fluid velocities and heat fluxes for channels heated either from one or two sides to study the effect of the different heating conditions.
- 3) Make a comparison between the case of upward flow and that of downward flow.
- 4) Determine the conditions under which the effect of natural convection is significant.

The results show that the natural convection for the channel heated from both sides is significant when  $Gr_x/(Re^{21/8}Pr^{0.5})$  is greater than  $8 \times 10^{-5}$ , for both the cases of upward and downward flow, and the heat transfer in the mixed convection region is slightly greater for the case of downward flow than that for the upward flow. For the channel heated from one side mixed convection is significant when  $Gr_x/(Re^{21/8}Pr^{1/2})$  is greater than  $4 \times 10^{-4}$  for aiding flow and greater than  $1.2 \times 10^{-4}$  for opposing flow.