# Modeling of a Counter Flow Plate Fin Heat Exchanger

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## Abstract

Plate fin heat exchangers are widely used for heat recovery or cooling purposes in many industries, such as cryogenics, aerospace and automobile industries. A plate fin heat exchanger transfer heat between fluids in the chambers formed by plates and fins, as shown in Figure 1. A counter flow plate fin heat exchanger operates with hot and cold fluids flow in opposite directions.

This paper developed a numerical model to simulate the heat transfer and fluid flow in a counter flow plate fin heat exchanger and optimize its design parameters. A representative repeating unit cell of the multi-channeled heat exchanger was taken as the computational domain, which includes a cold channel and a hot channel separated by plates, as shown in Figure 2. The conjugate heat transfer in the finned plate and fluids in the channels was simulated in COMSOL Multiphysics® software for an oil to water heat exchanger. Hot oil and cold water entered two separate parallel channels in opposite directions. The detailed distributions of temperature, velocity, and pressure were used to analyze the performance of the heat exchanger. The model will be further used to optimize its design parameters.

Figures 3 report the temperature distribution in the surface of the 3D computational domain and in the x-z planes along channel length directions. It can be clearly seen that hot oil enters the top channel with an uniform temperature of 330K and is cooled along the channel length and cold water enters the top channel with a temperature of 300K is heated along the channel length. Heat transfer between the two channels are through the channel walls.

The average fluids temperatures in the channels along channel length direction are shown in Fig. 4. Hot oil enters the hot channel with an averaged temperature of 330K and exits the channel with an average temperature of 323.7K. Cold water enters the cold channel with an average temperature of 300K and exits with an average temperature of 310.5K. However, the temperatures at the channel centers only slightly changed along the centerline. Oil temperature at the channel center only decreased 0.3K and centerline water temperature increased 1.5K.

# Figures used in the abstract

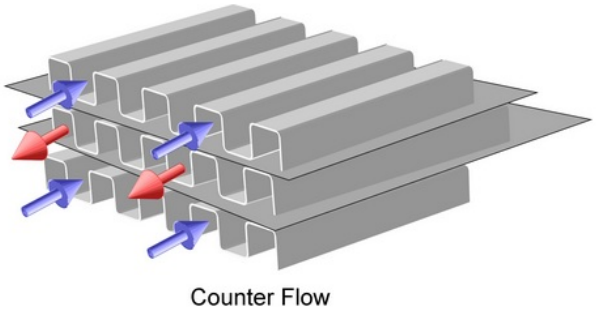


**Figure 1**: Fig.1 Schematic of a counter flow heat exchanger.

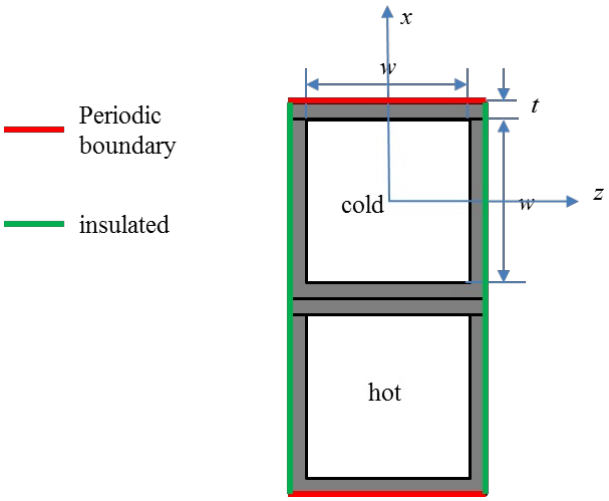


**Figure 2**: side view the computational domain consisting of one cold and one hot channels.

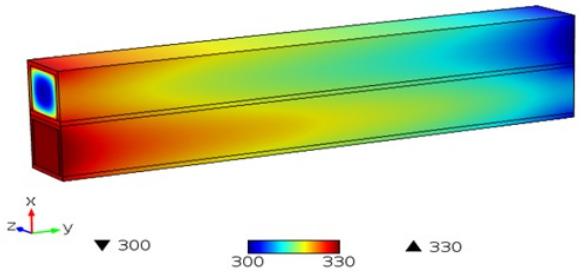


**Figure 3**: Surface temperature of the channels and walls.

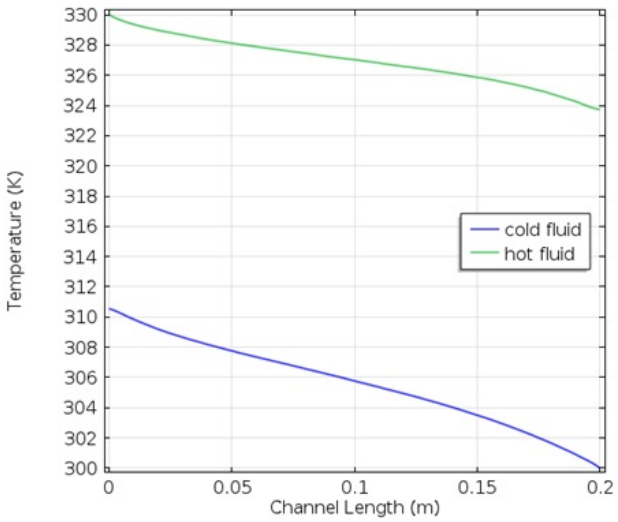


**Figure 4**: Average fluid temperatures along the channel length.