The effect of drastic parameters on optimization of developed layers in heat exchanger using constructural theory

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ABSTRACT

In the present work, optimization of air-cooled heat exchanger using structural theory of Bejan using Fluent software has been investigated. Two constraints are applied in the optimization process: the first one is to fix the overall area of heat exchanger, A, and second, the ratio of fraction of total heat exchange surface in the fixed pipe, ρ. Using these two constraints and the aforementioned theories, the best geometry, which is a symmetric geometry of the tube and the fins, was obtained. Furthermore, the effect of parameters such as pressure, Stanton number, ratio of fraction of the convective heat transfer coefficients, ratio of fraction of the conductivity, and the number of fins, etc. was investigated. The results show that for tubular length of 5.8 cm and 4.3 cm radius, the fraction of the overall fin diameter to pipe diameter is 1.88 and the optimal number of fins is 7. By using software such as Fluent and Matlab, the fins height and the distance between the fins were investigated. According to structural constraints, a structure was selected such that heat transfer from all the fins are equal. It was observed that the amount of the heat transfer was optimized by 6.2%.

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برای پرداختن از این مقاله، می‌توانید نمونه‌ای از متن کتاب‌های مربوط به موضوعات خاصی در علوم اجتماعی و سیاست بخوانید. به‌طور کلی، این مقاله به تحلیل مسائل و مشکلات اجتماعی و سیاستی از نظر مختلفی می‌پردازد. در این مقاله، به‌طور خلاصه، می‌توانید به پرداختن از این مقاله در مواقعی که به درک عمیق‌تری از موضوعات خاصی از نظر مسائل و مشکلات اجتماعی و سیاستی نیاز دارید، کمک بفرمایید.
4- معادله حاکم

از آنجا که سطح به عنوان یک محدودیت ناپذیر در نظر گرفته شده است، ما h₀ را برای رسیدن به طول دسته اصلی می‌گیریم. با استفاده از گزارال در ضریب انقلاب حرارت جابجایی، در ضریب انقلاب حرارت داخلی و خارجی و کلی دسته از مساحت همگن استفاده از ضریب انقلاب حرارت هدایتی و ضریب انقلاب حرارت داخلی به شکل شناختی با استفاده از این میدان‌ها صورت می‌گیرد.

سرش محدود کننده اول به فرمول (12) برای صحت می‌شود:

\[ \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \]  

(8)

\[ \rho \left( \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} \right) = -\frac{\partial P}{\partial x} + \mu \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) \]  

(9)

\[ \rho \left( \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} \right) = -\frac{\partial P}{\partial x} + \mu \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) \]  

(10)

\[ \rho C_P \left( \frac{\partial T}{\partial x} + \frac{\partial T}{\partial y} + \frac{\partial T}{\partial z} \right) = k \left( \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \right) \]  

(11)

- 3- معادله حاکم بر سطح

با برجوی ریز و انتقال حرارت راهی:

\[ q_w = \frac{h_1 (T_w - T_m)}{\frac{C_1}{\rho_c \partial h_1 \cdot L}} \]  

(12)

\[ \frac{q_w}{\rho D_1 h_1} = h_1 (T_w - T_m) \]  

(13)

\[ \frac{q_w}{\pi D_1 h_1} = h_1 (T_w - T_m) \]  

(14)

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(15)

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(16)

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(17)

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(18)

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(19)

\[ \frac{q_w}{\pi D_1 h_1} = h_1 (T_w - T_m) \]  

(20)

5- روش حل مسئله

در نرم‌افزار مدل براز حل معادلات آنلول نیوتن با استفاده از کد شایستگی

\[ \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \]  

(7)
شکل 2 مقطع هندسه

شکل 3 نمودار میزان وابستگی انقیان حرارت نسبت به سطح نواحی

شکل 4 مقایسه میزان انقیان حرارت با استفاده از شکل نواحی که کار حاضر و مرجع

شکل 5 مقایسه در این مقاله با سطح نواحی که کار حاضر و مرجع

شکل 6 شکل ورسی استقلال از شکل

شکل 7 بررسی استقلال

شکل 8 بررسی اختلال
in Fig. 177 some variations in heat transfer for a range of values of n. Figure 7 shows the relationship between 

\[ H/\Delta T \] and n for some values of n.

Table 1: Comparison of heat transfer in 2500 fins between present work and reference [10]

<table>
<thead>
<tr>
<th>n</th>
<th>q [10]</th>
<th>q in present work</th>
<th>Error percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>42.9277</td>
<td>43.1</td>
<td>0.4</td>
</tr>
<tr>
<td>0.4</td>
<td>42.0482</td>
<td>41.95</td>
<td>0.23</td>
</tr>
<tr>
<td>0.5</td>
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Table 2: Comparison of heat transfer in 4000 fins between present work and reference [10]

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Fig. 5 Heat transfer comparison diagram between present work and reference [17].

Fig. 6 Variations of \( \bar{q} \) with \( H/\Delta T \) for some n's.

Fig. 7 variations of \( \bar{q} \) with respect to \( \bar{\phi} \) for varying values of \( \bar{\phi} \).

In Fig. 6, variations of \( \bar{q} \) with \( H/\Delta T \) for some n's are shown. In Fig. 7, variations of \( \bar{q} \) with respect to \( \bar{\phi} \) are depicted for varying values of \( \bar{\phi} \).

8.1-1.2 

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Area weighted average in outlet: 498.721 K
\( Q = 0.067646 \times 418.2 = 31.578 W \)

\begin{align*}
\text{m: } C_p & \Delta T = U_r \cdot A \cdot \Delta T \\
\text{m: Mass flow rate: } & 0.067646 \text{ kg/s} \\
T \text{ inlet: } & 500 K \\
C_p & = 418.2 \text{ J/kg} \cdot \text{K} \\
\end{align*}

\begin{align*}
\text{Hall Tendency: } n \text{ } \text{versus } \frac{H}{D_f} \text{ and } n \text{ in three different values of } k_i/k_o.
\end{align*}

\begin{align*}
\text{Fig. 8 Variations of } n_{opt} \text{ with } \Pi \text{ for three Stanton numbers.}
\end{align*}

\begin{align*}
\text{Fig. 9 Variations of } q \text{ versus } H/D_f \text{ for different values of } k_i/k_o.
\end{align*}

- Variations of \( q \) with \( H/D_f \) for different values of \( k_i/k_o \).
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جدول 6 آزاد حرارت تخصص شده بر روی لوله و برده در پهن‌سازی نانو

<table>
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<tr>
<th>فصل از پره، (cm)</th>
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<th>پره</th>
<th>درجه C</th>
<th>فصل از پره، (cm)</th>
<th>میزان انقل حرارت (w)</th>
<th>پره</th>
<th>درجه C</th>
</tr>
</thead>
<tbody>
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جدول 7 مقایسه میزان عدد نامتانست موسیقی در دو پهن‌سازی

<table>
<thead>
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<th>لوله بدن شده</th>
<th>پهن‌سازی نانو</th>
<th>پهن‌سازی نانو</th>
<th>پهن‌سازی نانو</th>
</tr>
</thead>
</table>

نیم‌کردن حاکمیت کردن میزان انقل حرارت هسته‌ای می‌توان استفاده کرد.
11 - مراجع


