

传递现象

## 旋流片强化传热的数值模拟和场协同分析

周水洪, 邓先和, 何兆红, 李志武

英格索兰(中国)投资有限公司苏州研发分公司 华南理工大学传热强化与过程节能教育部重点实验室

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摘要

基于壳程周期性单元流道模型;采用数值模拟方法分析了一种新型的传热强化元件——旋流片作为管间支撑物的湍流流动与传热特性。数值模拟采用重整化(RNG)  $\kappa-\epsilon$  双方程湍流模型;SIMPLEC算法进行压力和速度的耦合;壁面处理采用强化壁面处理法。分析了单元流道横截面流场和湍流强度的周期性变化;以及截面上流场和温度场的协同关系。比较了截面平均Nusselt数和平均协同角的对应变化趋势。结果表明;旋流片使流体在管束间做三维螺旋运动;破坏了流体流动的连续性和稳定性;增强湍流强度从而强化传热;同时改变了管束间流体的速度场与温度场分布;旋流片强化传热的根本机理是改善了两场的协同关系。

关键词

[旋流片](#) [强化传热](#) [数值模拟](#) [场协同原理](#)

分类号

## Numerical simulation and analysis with field synergy of heat transfer enhancement by twisted leaf supports

ZHOU Shuihong, DENG Xianhe, HE Zhaohong, LI Zhiwu

### Abstract

Based on a shell-side periodic unit channel model, twisted-leaf tube bundle Based on a shell side periodic unit channel model;twisted leaf tube bundle support was investigated as a new type of heat transfer enhancement element;and the turbulent flow and heat transfer characteristics were studied by numerical simulation The RNG  $\kappa-\epsilon$  two equation turbulent model was used in the study The coupling between pressure and velocity was solved by SIMPLEC algorithm;and the enhanced wall treatment was adopted to solve the near wall flow and heat transfer The periodic distributions of velocity and turbulent intensity on the cross sections along the main stream were presented and the synergy between velocity and temperature fields was analyzed The local average Nusselt number on the cross section was compared with the local synergy angle It was found that twisted leaf support produced the 3 dimension helical motion which resulted in the disruption of the continuity and stability of the fluid The disturbing flow could promote turbulent intensity and enhance heat transfer effectively Meanwhile;the swirl flow changed the distributions of velocity and temperature fields;and the fundamental mechanism of heat transfer enhancement by twisted leaf was the improvement of synergy between both fields..

### Key words

[twisted leaf](#) [heat transfer enhancement](#) [numerical simulation](#) [field synergy principle](#)

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