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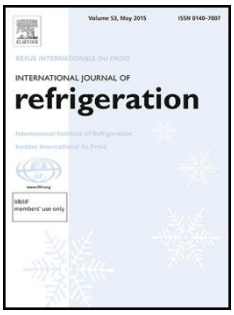

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Fluid Flow and Heat Transfer Characteristics of Separation and Reattachment Flow over a Backward-facing Step

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Highlights

- The flow instability and heat transfer instability increase with the increase of Reynolds number.
- The dissimilarity between the Nu and C_f appears downstream of the primary recirculation zone at Re = 1000.
- The combined effects of flow instability and heat transfer instability cause the dissimilarity between Nu and C_f.

ABSTRACT

In this study, a direct numerical simulation of the fluid flow and heat transfer characteristics of separation and reattachment flow at a backward-facing step is presented. A computer program of FORTRAN code is used to solve the governing equations according to finite volume method. The effects of the Reynolds number and expansion ratio on the fluid flow and heat transfer characteristics are investigated. The size of the primary recirculation zone increases with the reduction of expansion ratio and the fluctuation of isotherms increased with the increase of Reynolds number. The periodic characteristics and the dissimilarity between Nu and C_f appear in the transitional flow regime. The rotating fluids in the reattachment region increase the flow instability and the interchange of the hot and cold fluids increases heat transfer instability. The combined effects of flow instability and heat transfer instability play an important role in the formation of the dissimilarity between Nu and C_f.

Key words: Backward-facing step, Transitional flow, Heat transfer, Instability, Dissimilarity

1. Introduction

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