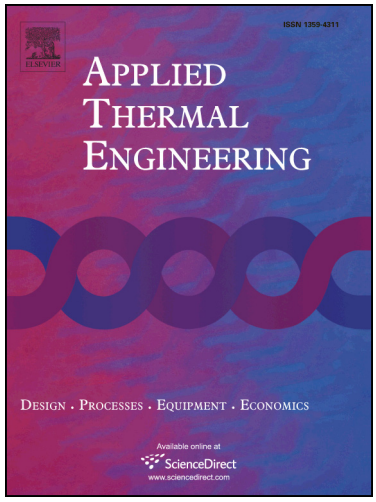

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Frictional Pressure Drop Correlation for Two-Phase Flows in Mini and Micro Multi-Channels

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HIGHLIGHTS

- A new correlation was developed to predict pressure drop in mini/micro multi-channels.
- A database of frictional pressure drop in two-phase flow in mini/micro multi-channels was collected.
- Homogenous and separated flow models of two-phase flow frictional pressure drop in multi-channels were reviewed.

ABSTRACT

1029 frictional pressure drop data of two-phase flow in mini/micro multi-channels were collected from 11 literatures. This database included 8 working fluids: R134a, R22, R404a, FC-72, water, CO_2, R236fa and R245fa. The channel dimension ranged from 0.109 to 2.13 mm. Frictional pressure drop range of the database was from 5 to 150 kPa. The applicability of 11 existing correlations developed for mini/micro single channels to mini/micro multi-channels were evaluated with the multi-channel database. Among the existing correlations, the correlation of Lee-Mudawar predicted the database with the mean absolute percentage error (MAPE) of 35.3 %, the correlations of Lee-Garimella and Sun-Mishima had MAPEs within 45.0 %. In the process of new correlation development, the database was divided into three categories (namely, 1: gas laminar-liquid laminar, 2: gas turbulent-liquid laminar, 3: gas turbulent-liquid turbulent) in terms of liquid Reynolds number and gas Reynolds number, since gas laminar-liquid turbulent data did not exist in the literature. The newly developed correlation was formulated by a function of the two-phase Reynolds number, Re_{tp}, the two-phase viscosity number, $N_{\mu_{tp}}$, and the vapor quality, x. The correlation could predict the measured frictional pressure drop with the MAPE of 18.9 %. The correlation demonstrated an excellent performance of the two-phase flow frictional pressure drop prediction in mini/micro multi-channels.

Key words: Two-phase flow; Frictional pressure drop; Multi-channel; Micro-channel; Mini-channel

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