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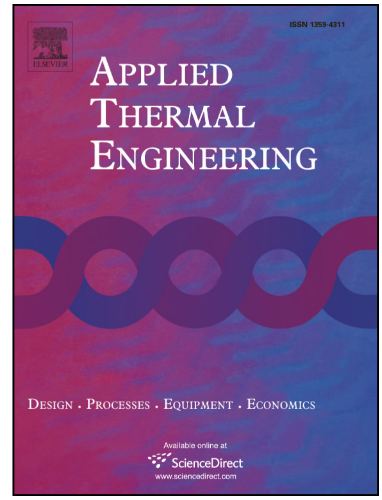

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Flow characteristics and instability analysis of pressure drop in parallel multiple microchannels

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Abstract

Instability analysis is vital for the safety of the system with microchannels, in which the microchannels could be used as a heat sink component with high heat efficiency. In this study, flow visualization and measurements of two-phase flow boiling in six parallel microchannels with a hydraulic diameter of 517 μm were conducted in order to investigate the dynamic instability in a microchannel system. The tests were performed in the range of mass flux 23.04 – 111.89 kg/ (m^2·s), heat flux 4.2 – 67.7 kW/m^2, inlet temperature 40 – 60 °C and exit vapor quality -0.06 – 0.12. The wavelet decomposition method was used for the oscillation characteristic analysis and the signal noise was identified successfully within the decomposition process. Combination of time-domain and frequency-domain analysis as well as the high speed visualization were performed for the characteristics analysis of the pressure drop. Entropy method was first used for the flow instability analysis in the microchannel system and noticeable differences of stable and unstable flow states were found due to its inherent flow patterns in microchannel system. A strong bearing was found between the characteristic oscillation period of dynamic flow and the corresponding boiling number.

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Keywords: Microchannel, flow instability, wavelet decomposition, sampled entropy method, characteristic oscillation period.

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