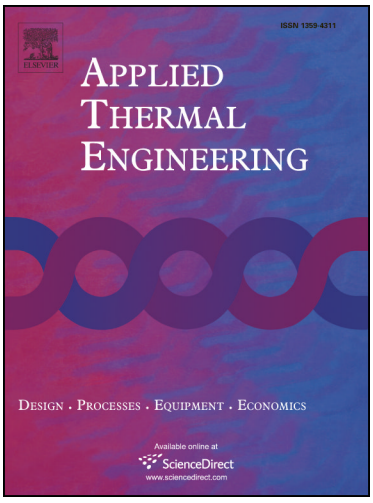

Research Paper

A complete set of simple and optimized correlations for microchannel flow boiling and two-phase flow applications

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A complete set of simple and optimized correlations for microchannel flow boiling and two-phase flow applications

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Highlights

- Eleven simple correlations were developed for microchannel flow boiling applications
- Critical heat flux, flow pattern transitions, Pressured drop were correlated
- Heat transfer coefficient, void fraction and liquid entrainment were correlated
- The new correlations could best predict their databases
- These correlations are important to speed-up numerical solutions of thermal models

Abstract:
In this work a complete set of simple and optimized correlations for flow boiling and two-phase flow conditions in microchannels were developed for prediction of the critical heat flux, flow pattern transition, heat transfer coefficient, frictional pressure drop, void fraction, slip ratio and liquid entrainment fraction in compact thermal applications. The goal was to identify and optimize a set of the dimensionless numbers associated with these parameters to obtain simple and easy to be implemented correlations but still with low prediction error. These simple correlations were characterized by three points: i) just one continuous function with few dimensionless numbers, ii) easily linearized and iii) a equation format that makes possible to obtain analytically the inverse function of any of its independent parameters. These characteristics are important when developing models for simulations of compact thermo-hydraulic systems, where linear models and fast numerical codes are desired. The third characteristic simplifies solution and convergence of system of equations by use of explicit methods. The correlations were optimized using the dimensionless numbers which better correlated to the experimental data. The experimental database was carefully selected for each parameter to cover a wide range of flow conditions and fluids used in microchannels applications. This set of simple correlations could predict their database with a similar or better performance than more complex correlations presented in literature. In addition, the analysis of all these prediction parameters together allowed identification of similarities and relations among the predicted parameters.

Keywords: Heat Transfer Coefficient, Pressure drop, Critical Heat Flux, Void Fraction, Liquid Entrainment, Flow pattern, Dryout.