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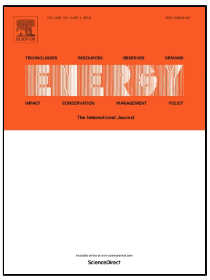

Statistical Method For The Determination Of The Minichannel Heat Exchanger's Thermal Characteristics

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STATISTICAL METHOD FOR THE DETERMINATION OF THE MINICHANNEL HEAT EXCHANGER'S THERMAL CHARACTERISTICS

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Abstract

The paper presents a new statistical method for the determination of the experimental thermal characteristics of mini- and microchannel heat exchangers. These exchangers are suitable for small scale ORC (Organic Rankine Cycle) installations, CHP (Combined Heat and Power) generation or other applications like electronic equipment. It is not possible in practice to measure the temperature inside mini- and microchannels and only statistical methods may be used to determine the exchanger's characteristics. There are many such methods which are the modifications of the Wilson plot method. However, the presented method has some advantages. Both fluid flows are treated symmetrically and flow rates and temperature values may be changed simultaneously. In many other methods it is necessary to stabilize one fluid flow while changing the second one. The correlations for Nusselt number may easily be chosen without changing the method itself. The linear coefficients are calculated analytically, but in the case of additional nonlinear coefficients, the numerical method may easily be used. The presented statistical method was verified based on the experimental data of the prototype minichannel heat exchanger.

Keywords: heat exchanger; investigation; statistical method; thermal characteristics

Nomenclature

A heat transfer area, m^2,
a,b sides of the channel's rectangular cross-section, m,
C correction coefficient,
c_p specific heat at constant pressure, J/(kgK),
d_e equivalent wall thickness, m,
d_h hydraulic diameter, m,
h specific enthalpy, J/kg,
L channel's length, m,
$\dot{m}$ mass flow rate, kg/s,
N number of measurements,
Nu Nusselt number,
n,m exponents of Reynolds and Prandtl numbers,